Annual Maintenance Number

ELECTRIC RAILWAY JOURNAL

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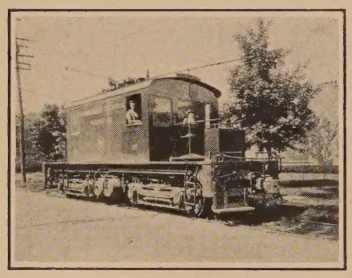

Good Maintenance Pays, But—

even the best will not keep a car or its equipment out of the obsolescent stage.

True economy in operation necessitates a well laid out program for replacing obsolete cars and equipment with rolling stock embodying all modern features: low floors; quick loading; rapid acceleration; good riding qualities; etc.

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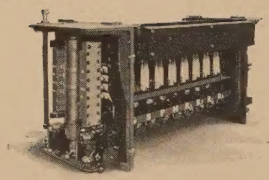

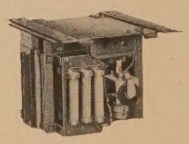

Westinghouse

New York, Saturday, March 21, 1925

Electric Railway Journal

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MORRIS BUCK, *Managing Editor*

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Annual Maintenance Number

The Maintenance Man Has a Real Job Today

MORE substantial progress has been made by the electric railways in the past two years than in any similar period of the industry's history. Business has increased, fares have been brought to the point where the average road can be made self-sustaining, and the financial structures of many properties have been strengthened. In a material way, too, the electric railways have come forward. Many new cars have been bought and much track has been built and rebuilt. Today the physical plant is in better condition than it has been for a decade or more.

Maintenance is the major problem that faces the industry today. For a short time, just after the various parts of the plant are renewed, they will work well even though but little attention is paid to repairs. If the railway systems are to be kept up to their present high standards, however, it will be necessary to pay more and more attention to maintaining the plant that has been built up in recent years, so that it will not fail to give its full measure of service.

In this lies the field of usefulness of the trained man who has made a study of problems of maintenance, and of methods of doing better work in less time and at lower cost. It is a real man's job. New cars and new track have brought with them changed problems. The maintenance methods of a generation ago are of little or no value today.

The leaders in the maintenance field are all the time developing methods which are fitted to present-day conditions. These are accomplishing the results sought and are providing a goal for others.

It is not so easy to be a follower, to adopt the methods that have been developed by another. But the wise leader is also a good follower. Not only is he at work on the development of new methods, but he is also reaching out into the field to draw to himself the best methods that have been worked out by others, changing them only if necessary to fit the conditions of a particular property.

Given a property, even though a poor one, the right sort of a maintenance man can find much to do, and he can reduce costs for his company so as to redound to his own credit. If he does his work faithfully and achieves results, the management should see to it that he receives a fitting reward in the way of remuneration and of promotion. For it is only by having an incentive that a man will put forth his best efforts and so obtain the best results.

Good Roadbed Maintenance an Important Factor in Interurban Popularity

DESPITE all that has been said of how the automotive vehicle has revolutionized the riding habit of the American citizen, the fact remains that the operation of commodious cars on smooth steel rails first gave him his taste for luxury in travel. Nothing has yet been developed to equal them in spaciousness and easy riding quality. Automobiling is extremely pleasant when the weather is fair and the road is good. By this means one can often reach attractive spots that are inaccessible by rail. Yet when all is said and done, if one takes a trip of any considerable length there is far greater comfort from a ride in a vehicle with steel wheels running on steel rails than in one with rubber tires running over the average highway.

A smooth roadbed well ballasted and well maintained is the greatest asset any interurban line can have. Possessing it, the electric railway can provide a service that has definite advantages over that of the automobile or the steam railroad. Usually the steam railroads make no particular attempt to attract passenger traffic between cities comparatively close together. The interurban railway, with more frequent service and equally commodious cars, is in a good position to secure much of this business. Compared with the automobile, the interurban is unquestionably cheaper and offers a more spacious vehicle operated over a smoother roadway.

It is surprising to see how some interurban managements throw away the great inherent advantage of steel wheels running on steel rails. By neglecting properly to maintain their track and roadbed they allow the surface of their rails to become so uneven that much of the pleasure of riding is lost. Often the same companies are careless about the maintenance of their rolling stock. What ought to be a pleasant ride, swift, quiet and comfortable, becomes an ordeal during which the passenger must endure the swaying, jolting, banging, rattling and creaking of a car operated over rough track.

Where such conditions exist it is not difficult to see why people prefer to travel by automobile or by steam railroad. This condition is not by any means true of all interurban lines. But on a considerable number of properties more attention should be paid to the matter of roadway maintenance.

Better Bus Maintenance in Railway Operation

ON MANY electric railways bus maintenance has now become a problem of considerable importance. Just as there is no ultimate economy in allowing track or rolling stock to deteriorate, there is none in neglecting the upkeep of buses. The necessity for adequate maintenance is sometimes overlooked. In reality it is of even greater importance because the bus is subjected to greater vibration. From its very nature the internal combustion engine racks the bus body and chassis more than the electric motor does the body of a street car. The weaving of the chassis frame due to inequalities in the road is another inherent cause of vibration.

One of the advantages of co-ordinated bus and railway service is that the railway managements are already thoroughly familiar with the necessity for and general problems of shop organization and rolling stock maintenance. They know that it is necessary to have a systematic plan, adequate facilities and to keep accurate records. Moreover, their resources are such that it is possible for them to provide these things.

As yet the bus is too young for maintenance to have become thoroughly standardized. A number of smaller railways have facilities for making repairs in existing carhouses. Where bus operation has replaced car operation, or where it has been possible to transfer cars to some other location, in some cases carhouses have been converted into bus repair shops. But generally speaking, the railways have provided buildings designed for garage purposes.

Bus maintenance personnel is ordinarily separate and distinct from the car maintenance personnel. This is largely because the equipment of the bus is so different from that of the car that its proper care requires men with specialized training.

Inaccessibility of parts has been one of the difficulties of bus maintenance. This is a matter that deserves careful consideration. Within a comparatively brief time, however, the bus has changed from being simply a body mounted on a truck chassis into a vehicle designed especially for passenger transportation, and it is not unreasonable to expect that as time goes on other improvements will come in the design to make maintenance cheaper and easier.

Reduction of Noise Is a Good Investment

THE interest being taken in the reduction of noise in street car operation cannot fail to mark the beginning of a new era. This subject must be taken seriously. Competitive conditions demand it, and the cost of noise reduction ultimately will be justified by actual savings effected as well as in the intangible valve in good will and increased revenue that may be laid to quieter operation.

A decided improvement in existing conditions is not impossible, nor even especially difficult. Consider the properties of today. Those that keep their track and equipment in good condition have the quietest operation. As pointed out in another editorial in this issue, the greatest wear comes from rubbing between parts that are not tightly held together. Is it to be wondered that a car with loose parts is disagreeably noisy? Practices that permit these conditions cannot be justified. Yet they do exist. It takes money to rectify them now. But if the necessary money be spent to correct them, is there any doubt that in the end real economy will be shown?

The justification for bringing the standards of maintenance to the highest plane is readily apparent to the mechanical man. It exists not only in the reduction of noise but in longer life of the parts. Higher maintenance standards, as applied to noise reduction, mean essentially closer fits. This in turn means less vibration and sound. It also means that these close fits will be maintained longer. This latter statement is demonstrable by test. The proportional added expense to secure higher standards of maintenance as compared with the value of the added life of parts has not been worked out, but it is doubtful if the net cost will be much if anything. There may even be a reduction in expense.

Some of the maintenance factors which will contrib-

ute particularly to reducing car noise were discussed in an editorial in the Feb. 28 issue of the JOURNAL.

As to changes in design, there is a wide field for endeavor. So long as steel wheels roll on steel rails there will be some noise, but the amount of that noise is capable of material reduction. Modern design of trackwork has tended toward rigidity. Car design has had a similar trend. Both of these aggravate the noise. Body and equipment noises by themselves are of relatively minor consequence now, because their volume is less than that of track and wheel noises. But if the latter are reduced to a minimum, these other noises will stand out more prominently, so that they should not be neglected. For both classes of noises there are remedies. Steps have been taken in individual cases to eliminate several of the sources. While they are experimental as yet, there is no inherent reason why a concerted effort should not be made to bring together all the plans that have been proposed and work out a real campaign for promoting quietness in operation.

In the quest for economy we have perhaps forgotten that we have something for sale that must be made popular—not only to the riding public, but also to the listening public along the car routes. In the end these are the potential riders who can be attracted or repelled by what they see and what they hear. So it would seem that as a question of policy the problem of noise should be attacked and conquered, entirely apart from the value of quietness from the mechanical standpoint.

Good Maintenance Is Cheap Maintenance

NOWHERE is the old adage "A stitch in time saves nine" more apt than in connection with electric railway maintenance. Vibration and rubbing between adjacent surfaces are major causes of failure in many parts of railway track and equipment. Rail joints that are tight never give any trouble; but let the joint begin to loosen, and motion between the rails, the joint plates and the connecting bolts is accelerated until within a short time it is impossible to make a satisfactory repair by any method short of cutting out the joint and inserting a new piece. Meanwhile vibration has broken the paving and the foundation. The same thing is true of car parts. Fitted joints in bodies, trucks or motors give no trouble until there is a slight tendency to looseness. Then chafing ensues and causes the abutting surfaces of the parts to wear away, increasing the trouble rapidly until they fail completely.

Accidents are often caused by the practice of letting the maintenance go until the wear has reached a point that it is considered unsafe to wait any longer for a repair. Sometimes the judgment of the inspector is faulty in that the repair is deferred until long after the danger point has been passed and the factor of safety wiped out.

Then, too, the cost of the repair, when it finally is made, increases much faster than in proportion to the length of time the work is deferred. A loose joint in a car part requires only tightening a few bolts when it is first observed. A little later it may require an expensive building up of the parts with the welder, followed by machining of the adjoining surfaces. Usually this will require disassembling of the parts so that the work may be done, followed by a reassembly, with a considerable waste of labor.

Why a management can imagine that deferring maintenance saves money it is difficult to see. Yet the practice is indulged in by many roads every time there is a call for drawing down on the pursestrings. The number of trainmen cannot be reduced, nor can their pay be cut without the possibility of labor troubles. Maintenance work can, however, be partially neglected for a time without anyone being the wiser. Sooner or later it will be necessary to pay the piper—and the charge will not be a light one. It is far better to have the maintenance work done well, and done when its need first becomes apparent. The saving will be obtained not only in a direct reduction of maintenance costs, but in better performance on the street and a reduced number of interruptions to service. The cost of items such as these can never be measured directly; but it is a factor that always enters in the final analysis.

Central Master Mechanics Would Improve Their Work

IN THIS ISSUE is reported the organization of the Central Electric Railway Master Mechanics' Association. Its purpose, as expressed by representative speakers at the meeting, is to study and compare methods and practices so as to enable the mechanical men to serve better the roads on which they are employed —to enable them to improve their work.

The master mechanics contend—and rightly so—that upon them rests a very important part of the responsibility for maintaining a satisfactory interline business. They believe that greater uniformity in equipment design and maintenance and in inspection standards will bring about improved service to shippers and reduced costs to the carriers. They point out that it is imperative to reduce delays while waiting for special maintenance parts and transfer of shipments due to defective equipment.

To these objectives the new organization has been dedicated. If the executive committee approves the proposal the members of the new association will be affiliated with the C.E.R.A. much in the same way as are the Central Electric Railway Traffic Association and the Central Electric Railway Accountants' Association. The master mechanics expect to hold some of their meetings at various railway shops in the territory, so that they can compare and discuss practices at first hand. The new plan, it is claimed, will save time and produce more concrete results than has the Engineering Council, where maintenance-of-way and power distribution subjects were considered, as well as equipment practices.

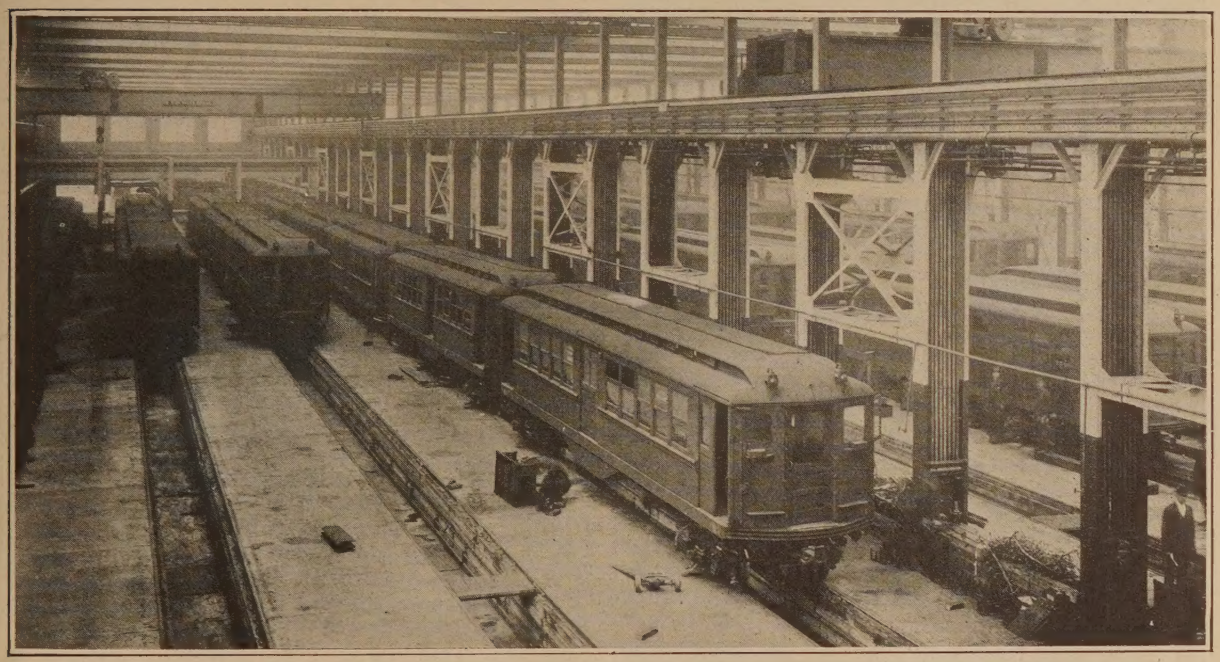
The plan includes many potential possibilities for effective and constructive activity guided by group thinking and effort. The leaders in this movement are to be commended for their initiative and progressiveness. It is unfortunate that they felt the results desired could not be accomplished through the present Engineering Council, even with some modifications in its organization. But if the new plan helps the master mechanics to improve their work, the maintenance-of-way and power distribution men may follow a similar procedure. After all, the results are the only factors that are of importance—the mechanism is incidental.

Repair Shops of the Interborough Rapid Transit Company

THE Interborough Rapid Transit Company has two main repair shops. The one shown in the upper view is that originally used by the Manhattan Elevated Railway. It is between 98th and 99th Streets on Third Avenue and occupies the greater part of two city blocks. The yard on Third Avenue is on a level with the elevated structure. The lower view shows the new shops and the office building at 147th Street and Seventh Avenue. These shops, yards and storage space, when completed, will extend along the Harlem River from 145th Street to 151st Street, with western frontage for part of the property on Lenox Avenue and for part of the property on Seventh Avenue. Of the detail views accompanying this article those on pages 442 to 445 inclusive were taken at the 98th Street shops, and those on pages 447 to 449 inclusive were taken at the 147th Street shops.

Maintenance Methods on the Interborough

Under a Most Exacting Service, an Efficient System of Car Maintenance Has Been Built Up, by Which Delays per 1,000,000 Car-Miles Have Been Kept to a Low Figure



One of the Inspection Bays at the 147th Street Shops

THE immensity of the task of maintaining the rolling stock of the Interborough Rapid Transit Company can be gathered from a few statistics of the traffic conducted, as compared with trunk-line railroads. During the calendar year of 1922, the last year for which statistics of this kind are available, the entire revenue-passenger business on the steam railroads or trunk-line railroads of the country (Classes I, II and III) reporting to the Interstate Commerce Commission amounted to exactly 989,509,000 passengers, and it is estimated that the few small roads outside the jurisdiction of the commission would not be sufficient to make an aggregate of 1,000,000,000 passengers. During the same year, however, the twelve months ended Dec. 31, 1922, the number of passengers carried by the Interborough Rapid Transit Company was 1,001,730,481. This number was divided approximately two-thirds on the subway division and one-third on the elevated division. Yet this number was carried practically without accident. The figures of passengers carried by the Interborough for 1923 and 1924 are given in Table I.

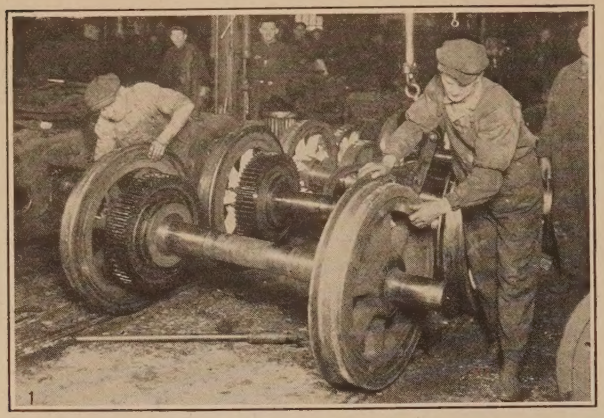
THIS ARTICLE describes the nature and extent of the repair problem, the methods followed in carrying out repairs and the organization by which this work is conducted in the shops of the Interborough Rapid Transit Company of New York. Previous articles on the repair shops, inspection methods and inspection shops of this company appeared in the issues of May 3, 1924; Aug. 16, 1924, and Aug. 30, 1924.

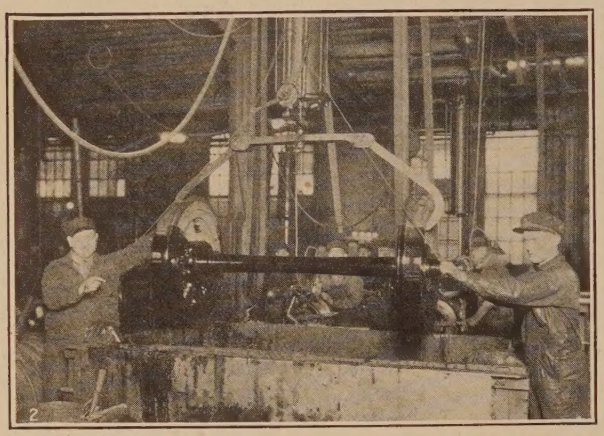
TABLE I—PASSENGERS CARRIED BY THE INTERBOROUGH RAPID TRANSIT COMPANY

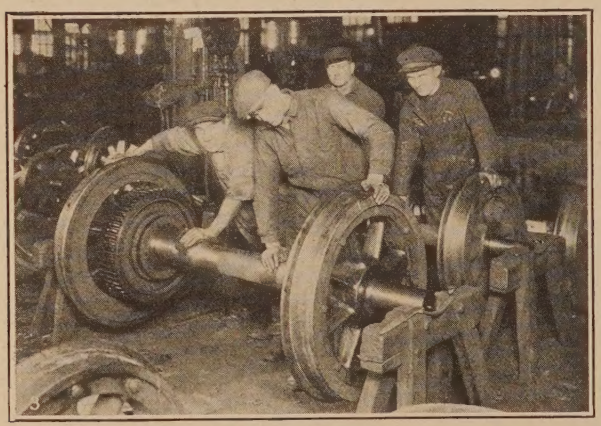
	1923	1924
Subway	693,069,053	729,029,664
Elevated	355,143,240	357,528,667
Total	1,048,212,293	1,086,558,331

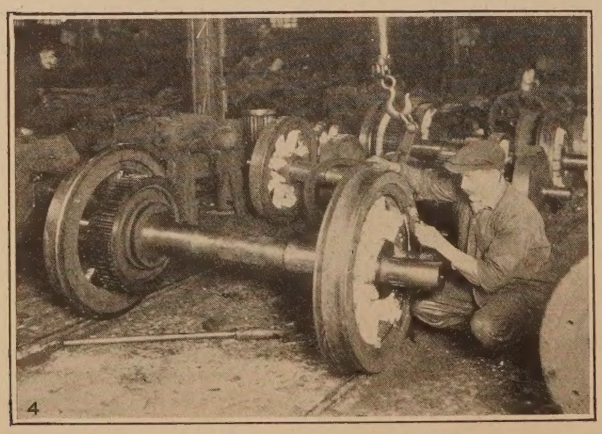
The extent of the operations of the Interborough Rapid Transit Company can be indicated in another way. Each month this company operates between 15,000,000 and 17,000,000 car-miles. This mileage is more than that which would be taken by the operation of a subway car 20 times around the circumference of the earth at the equator every day for a month.

It is not only in number of passengers carried and car-miles run that the performance of the Interborough Rapid Transit lines is remarkable. The service conditions are probably the most severe in the world. Trains made up of steel cars, weighing between 38 and 40 tons each, have to be started, brought up to full speed and then braked to a stop, all day, at intervals of only about 1½ to 3 minutes. Frequently on the subway individual cars average more than 5,000 miles per month, and during this time they have to make from 12,000 to 15,000 starts and stops. Again, if a car develops a defect after it has been put in service in a train, it cannot easily be cut out and put on a siding or hauled on a branch track to the repair shop, as would be the case with a line operating on the surface. If it breaks down entirely it delays not only its own train but every



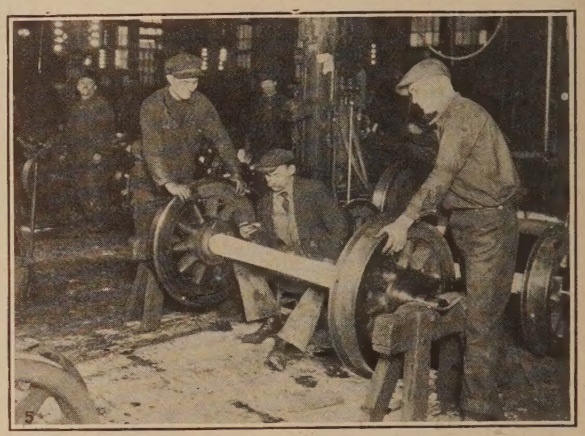






other train on the same track behind it and means a large loss of fares, as well as discomfort to the travelers. This demands that, in spite of the tremendously arduous railway conditions prevailing in subway operation, breakdowns from mechanical defects and pull-ins have to be kept practically to zero.

Finally, unlike most surface lines, rapid transit lines exist only where population density is high and where, in consequence, real estate is very expensive. This means that the repair shops and maintenance shops have to be designed to permit the smallest amount of space per car with which the maintenance department can get along. Added to all of these conditions which face the Interborough Rapid Transit Company, the city of New York, which is responsible for providing the necessary shop and inspection facilities under the dual



contracts, is far behind in this part of its program. It is true that now, after long delay, the shop and inspection facilities of the company are being extended by the city, as described in the previous articles referred to, and an especially needed extension of the repair shops at 147th Street and Lenox Avenue for the subway division is now in course of construction. When this is completed, some time during this year, it will help the situation greatly.

In the meantime, of course, the company has not been able to wait for these new facilities and has had to conduct both inspection and repair work as best it could. In these circumstances, the low record of the company in delays per 1,000,000 car-miles from mechanical and electrical causes, as shown in the upper chart on page 444, is remarkable.

Careful records are kept of the number of cars shopped for different causes. The charts shown on page 444 are typical records of this kind.

Table II shows car-miles operated on the two divi-

The Five Illustrations on This Page Show the Methods of Inspecting Wheels by the Vibration Test and Magnifying Glass

As explained in the text, a great deal of study has been given by the engineers of the Interborough Rapid Transit Company to methods of testing wheels, axles and pinions. The five accompanying views show the processes used when the wheels come into the repair shop. (1) The dirt is scraped and wiped off. The axle is then immersed in a lye tank for 30 or 35 minutes, and then thoroughly cleaned with waste. (2) It is then put in a hot bath of oil, and (3) then wiped clean and dry again. (4) The axle, wheel and spokes are then coated with whiting and the axle is vibrated with a hammer. (5) It is then carefully examined with a magnifying glass for evidence of detail fractures. Any crack is usually at the junction of the wheel and axle. Three of the views show a motor axle and two show a trailer axle. Both are treated in the same way.

sions for the 14 months ended with February, 1925. Table III gives the number of cars owned last fall, i.e., not including those on the recent order.

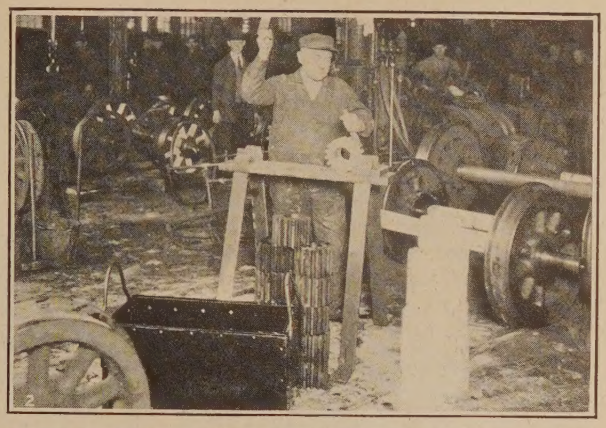
ORGANIZATION OF MECHANICAL DEPARTMENT

The car equipment department of the Interborough Rapid Transit Company is headed by a superintendent of car equipment, who is also assistant to the general manager. The fact that the head of the mechanical department is thus also in close official connection with the highest councils in the company shows the importance in which good maintenance is held on the Interborough and the authority which it is realized he should have. This official, James S. Doyle, has charge of all of inspection, maintenance, construction and engineering of rolling stock on both the elevated and subway divisions.

1

The company makes a distinct separation between its inspection work and its repair and overhaul work. The inspection is conducted in nine special inspection shops, located at different points in the system, as described in the previous articles mentioned. In these shops all cars are inspected on a mileage basis, the motor cars after every 1,000 miles and the trail cars after every 1,200 miles.

The repairs, except such light repairs as are carried on at the inspection sheds incident to inspection, are done at one of the two repair shops of the company. The subway rolling stock goes for all repairs except painting to the shops at 147th Street and Lenox Avenue, now being doubled in size. The cars for the elevated system are repaired at the shops belonging to the Manhattan Elevated Railway at 98th Street and Third Avenue. All painting of cars is also done at these shops. A considerable number of the executives connected with the maintenance department of the company have their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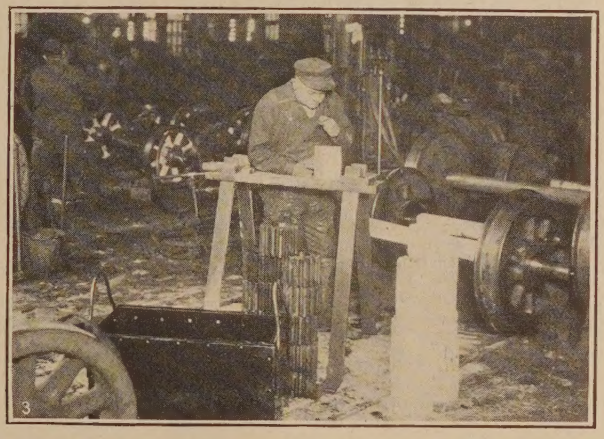
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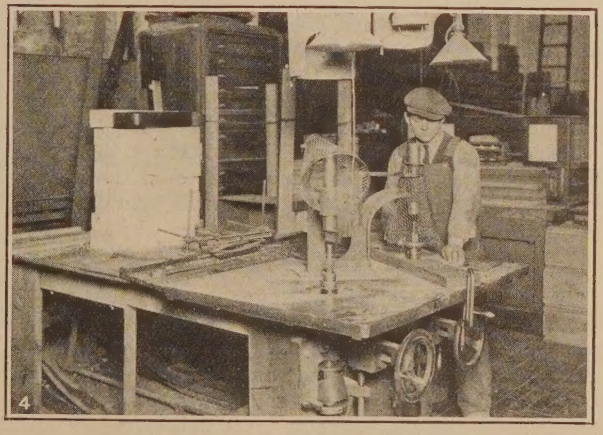
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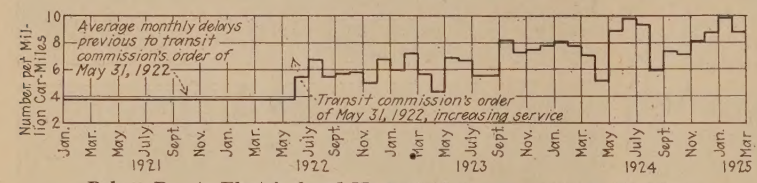
The Five Illustrations on This Page Show Babbitting, Pinion Testing and the Safety Features of Mill Practice

The first view shows the babbitting room at the 98th Street shops. The babbitt furnaces, the pyrometer and the racks for bearings of different sizes are at the right. There is still a larger babbitting room at the 147th Street shops. The next two views show the method of testing new motor pinions by the vibration method. It is very similar to the method used for testing wheels, as described on the opposite page. View 2 shows the blow being given to a pinion coated with whiting. Below are piles of coated and uncoated pinions and an oil bath tank. View 3 illustrates the examination of these pinions with the magnifying glass. Views 4 and 5 are from the wood mill in the 98th Street shops. The machine in View 4 is a variety molder and shaper. Note the mandrel which slips over the end of the shaft to hold it in place. Note also the safety guards over the revolving parts. These guards are so arranged that while they can be raised they cannot be removed from the machine. View 5 is of a circular saw and also shows a guard so arranged that it cannot be removed from the machine.

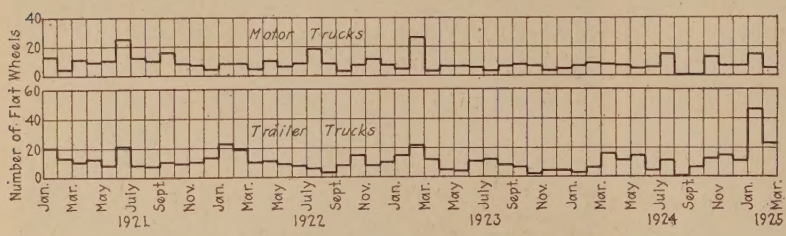
offices at the shops at 98th Street and Third Avenue, and here also is the office of the superintendent of car equipment.

At these shops each car on the system is thoroughly gone over at least once a year, at which time all necessary repairs are performed. In addition, the heavy repairs, which, because of their character, are such that they cannot be advantageously performed at the inspection and running repair shops, are also carried on in these shops.

The principal causes for which cars are sent from the road to the repair shop, except at overhauling times, are: Armature and field trouble, wheel turning, worn journals or truck repairs, heavy car-body repairs and painting.



Delays Due to Electrical and Mechanical Causes—Subway Division



Wheels Flat—Manhattan Division. The Upper Drawing Is for Motor Trucks, the Lower Drawing for Trailer Trucks

When a car comes into the repair shop, regardless of the nature of the trouble, a careful inspection is also made of the car body, including brake rigging, interior of body, platforms, roofs, sills, body bolsters, and control apparatus. If any defect is discovered the necessary repairs are made. In addition, a regular schedule is carried out with all cars.

Car Wiring Tests at Repair Shop

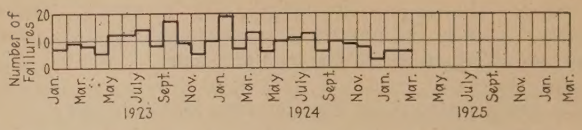
The control apparatus and car wiring are subject to the following inspection and tests as cars go through the shop.

The controllers are inspected, and if any worn fingers are found they are changed and new fingers are installed and adjusted. If any controller cylinders are found with worn or loose segments, they are removed and sent to the machine shop for repairs. The finger blocks and arc chutes are thoroughly cleaned and any necessary repairs are made. All mechanical parts such as shafts, pinions, gears and levers are repaired and readjusted, where this is needed.

All contactors are tested and inspected, and all worn or burnt contact tips, arc chutes, shunts, interlock fingers and worn mechanism base plates are replaced with new parts. All wire connections are gone over and tightened.

The reversers are tested, cleaned and oiled. All worn or burnt fingers or segment boards are replaced. All wire connections are tightened.

The line switches are tested, and all worn, burnt or broken tips, levers, arcing horns and arc chutes are cleaned or replaced with new parts. Worn overload trip contacts and interlock fingers are replaced and adjusted. The operating magnet valves are overhauled and pin valve seats are ground on a six months basis.



Road Failures Due to Grounded, Open and Short Circuited Train Line Jumper Wires

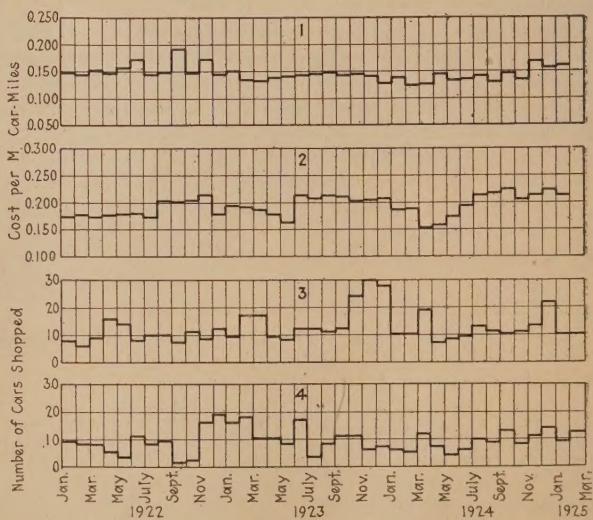
The rheostats are inspected for broken or fused grids and loose connections. At this time, broken or burnt insulators are replaced and the insulating collars are cleaned and shellacked.

The coupler sockets are inspected, particularly for loose or cracked insulation blocks and for loose or broken contact fingers and covers.

All switches and fuse base and connection boxes are inspected, particularly for loose parts, and all connections are tightened. All wires are examined for broken strands.

Before any car is allowed to leave the repair shop the electrical wiring on the car is given a high-tension test of 1,200 volts, for break-down of insulation, short and open circuits and grounds.

The truck trolleys and motor leads are inspected and removed on a time basis. The interval for the truck trolleys is every 18 months and that for the motor leads every 24 months. The flexible jumper connections between the cars, on which the reliability of the service depends to a large extent, are removed on a time basis of 18 months. The old jumper cable is scrapped and new cable is used so that the jumpers will be in 100 per cent condition.

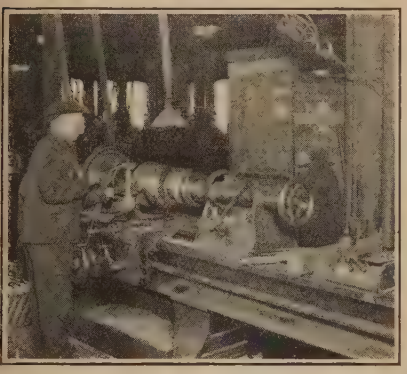


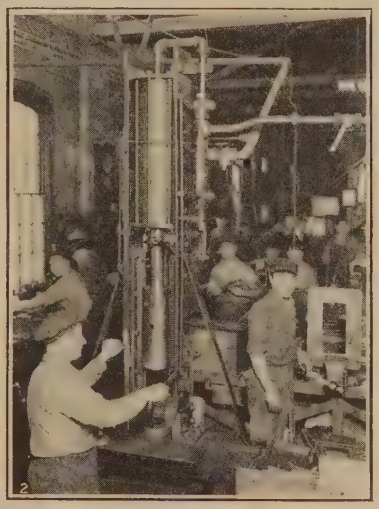
A Few Typical Charts of Maintenance Records

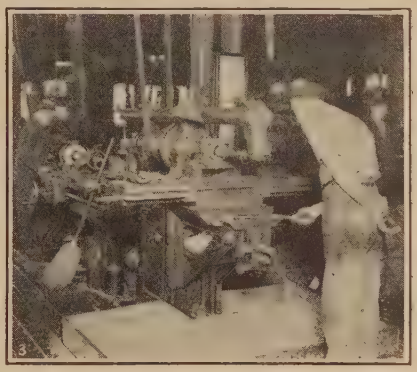
No. 1. Lubrication cost per thousand car-miles — Manhattan division.
No. 2. Lubrication cost per thousand car-miles — Subway division.
No. 3. Cars shopped for pinions and gears—Subway division.
No. 4. Cars shopped for car body defects—Subway division.

All wire used on the cars is made to the Interborough's specifications. These specifications are very rigid, calling for 30 per cent pure Para rubber. Wire is purchased by the company only from certain manufacturers who have been found able and willing to make wire that meets the company's specifications.

While the car bodies are going through the body repair shop, the trucks, brake rigging, air compressors, air brake equipment and trip devices are sent to a separate department where they are thoroughly inspected and the necessary repairs are made. All drawheads, pins and coupling links and also all pinions and gears are checked up for wear with a limit gage. Before a car is returned to service the air brakes, control and motor circuits are tested and the brakes are adjusted. At the same time, the car body is checked for height and side bearing clearance.







Four Interesting Machines in the Machine Shop at 98th Street and Third Avenue

Views 1 and 3 show the lathes used in turning axle brasses. The outside of a pair of journal brasses is being finished in View 1 and the inside in View 3. The two halves are held together by a band so they will make a perfect fit. The ring on the arbor of the boring tool in View 3 is a measuring gage. View 2 shows a pneumatic hammer for forming fiber disks for magnetic coils, washers, etc. This hammer was made from pick-up material in the shop. The fiber disks formed on this machine are first punched flat from strips. Then they are laid on a hot die and stamped to a dished form with this pneumatic hammer. This is a great saving in time over the old way of turning these disks on a lathe. A safety feature of this hammer is that the operator must use both hands on the machine while the hammer descends. The machine in View 4 is a device for winding brass wire into the form of spiral armor for motor and other leads. One great advantage of this machine is that it makes this wire armor of uniform size. It is also very rapid. The former method of making this armor was with a lathe with which 1,000 lb. of armor a week was a good record. This machine winds 1,000 lb. easily in a day.

Because of the high speed and the limited clearance of the cars with parts of the subway structure, good axles are even more of a necessity than on most electric railways. The company's specifications for axles are known among manufacturers to be very exacting. The original axles were annealed, but many years ago specifications were changed to call for higher-grade heat treatment such as is now used in the best automobile practice. Since the adoption of these specifications there has never been an axle failure under any of the Interborough cars. Although the use of this heat-treated material appears to be entirely safe, the company has always taken the extra precaution of having axles rigidly inspected at the mills before installation and subsequently tested periodically in service. The axles are tested at the shops on a 50,000-mile basis in the following manner:

The wheels and axles are removed from the trucks, and all rust and scale are removed from the axle. The axle is then immersed in a lye tank for 35 minutes. It is then thoroughly wiped clean with waste, after which it is put in a hot bath of oil at a temperature of 240 deg. F. for 35 minutes and again wiped clean and dry. The axle is then coated with whiting and alcohol. It is then vibrated and carefully examined with a magnifying glass for evidence of detail fractures. Views of these tests are given on page 442.

The same test of being cleaned and oiled, then coated with whiting and vibrated, is applied to the wheels and also to the swing hangers, equalizer bars, king pins, car-body brake rods, pinions and axle cap bolts on all trucks when they are passing through the repair shop.

All pinions are heat treated. In the vibration test given to them every tooth is vibrated and examined for defects. Axle cap bolt lock washers are of the type known as parallel washer, made of high-powered steel. They are scrapped every time bolts are removed.

Motor Maintenance

The company has a large variety of motors, as shown in Table IV. The controller equipments are also listed in Table IV.

As motors go through the shop all field coils and armatures are inspected and tested for defects. Those found in bad order are tagged with a "bad order" card. This card, which is 5½ x 7 in., carries an illustration of a field coil or armature, on which the position of the defect may be marked. The back of the card contains space for further remarks, as well as a duplicate illustration of the field coil or armature. Bad order tag cards for field coils are printed on white stock, those for interpole fields on blue stock and those for armatures on buff stock.

While the cars are in the shops all armatures are gaged and tested for lateral motion. The brush-holders are removed and the brush-holder insulators are cleaned.

TABLE II—CAR MILES OPERATED BY INTERBOROUGH RAPID TRANSIT COMPANY

1924	Manhattan Division	Subway Division
January	5,846,507.86	10,612,235.92
February	5,640,206.58	9,904,537.68
March	5,900,367.18	10,647,975.80
April	5,733,409.04	10,363,926.38
May	5,858,668.02	10,586,635.78
June	5,647,319.86	10,252,600.48
July	5,840,973.64	10,646,098.08
August	5,811,159.04	10,687,431.32
September	5,609,906.34	10,359,475.78
October	5,925,431.38	10,855,921.44
November	5,437,824.74	10,236,859.74
December	5,781,432.86	11,279,051.20
1925:		
January	6,065,499.22	11,572,098.04
February	5,173,410.02	10,304,671.20

TABLE III—CARS OWNED BY INTERBOROUGH RAPID TRANSIT COMPANY

	Manhattan Division	Subway Division
Motor cars	1,483	1,464
Trailer cars	715	669
Total	2,198	2,133

TABLE IV—MOTORS AND CONTROL EQUIPMENT OWNED BY INTERBOROUGH RAPID TRANSIT COMPANY

MOTORS OWNED

Manhattan Division	
GE-66	1,673
GE-211	178
GE-220	6
GE-259	296
WH-302	240
WH-333-L -3	594
Total	2,987
Subway Division	
GE-69	418
GE-212	460
GE-211	4
GE-240-C	12
GE-259	152
GE-260	878
WH-86	540
WH-300	198
WH-302-F-2	12
WH-577	338
WH-33-L-3	46
Total	3,058

CONTROL EQUIPMENTS

Manhattan Division	
Type M-GE	937
Westinghouse Air	79
Low voltage—GE	200
Low voltage—WH	276
Non-Revenue	
Type M-GE	8
Subway Division	
High voltage:	
Bridge-GE	327
K-GE	333
Low voltage:	
PC-2-GE	6
214-WH	6
PC-8-GE	124
214-A-WH	402
PC-10-GE	266
Total	1,464

At the same time the brush-holder tension is tested with a spring balance. The commutator and the armature as a whole is also inspected and given an electrical test.

Turning Rolled Steel Wheels

The rolled-steel wheel is used exclusively on subway division motor trucks. Previous to its development, less than 20 years ago, steel tires were used, but owing to the high rates of braking they were not satisfactory. The heat from the action of the brakes used would tend to loosen the tire and special means had to be adopted to correct this trouble. The development of the rolled-steel wheel was therefore very acceptable to the operators of the rapid transit lines in New York. The

Samples of Piecework Prices Used in Painting Manhattan Division Standard Cars

NOTE: Contracts include refinishing all work found unsatisfactory by foreman or inspector; preparation work; stacking and racking work; delivery of material to and from car and bench, etc.

Body Exterior—Motor or trail car, burn off enamel with burning machine, sand and putty, letterboards, side and end window posts, window stops, post battens, pier panels, window stools, aprons, sheathings, panels, battens, end body doors, end door posts and headers, door post battens, body corner posts and battens, bulkhead panels, hood bows, hood sheathing, and end stationary sash. Operations:

Burning, per car	$11.66
Sanding, per car	$2.54

Body Exterior—Motor or trail car. Enamel (orange color). Side and end window posts, window stops, post battens, pier panels, window stools, aprons, sheathings, panels, battens, end body doors, end door posts and battens, body corner posts and battens, end stationary sash. Operations:

Enameling, first coat, per car	$1.55
Enameling, second coat, per car	$2.07

Body Exterior—Motor or trail car. Enamel (black color). Letterboards, lower deck crown moldings, end door headers, bulkhead panels, hood bows, hood sheathing and battens. Operations:

Enameling, first coat, per car	$0.86
Enameling, second coat, per car	$0.95

Clear Story—Exterior motor or trail car. Enamel (black color). Upper deck sill and plate posts, panels, moldings and sash stops, carlin ends, roof sheathing at eaves, and hood sweep panels. Operations:

Enameling, first coat, per car	$0.68

Body Exterior—Motor or trail car. Re-enameled type. Sand and putty, letterboards, side and end window posts, window stops, post battens, pier panels, window stools, aprons, sheathing, panels, battens, end body doors, end door posts, and headers, post battens, bulkhead panels, hood bows, hood sheathing, end stationary sash, upper body side and end sash. Operations:

Sanding, complete, per car	$1.40
Puttying, complete, per car	$0.33

Body Exterior—Motor or trail car. Re-enameled type. Enamel (orange color). Side and end window posts, window stops, post battens, pier panels, window stools, aprons, sheathing, panels, battens, end body doors, end door posts and battens, end stationary sash, upper body side and end sash. Operations:

Enameling. Apply first coat, per car	$1.85
Enameling. Apply second coat, per car	$2.20

Lettering, etc.—Motor or trail car. Exterior. Letter side panels or side sheathing in dark blue color, letterboards orange color, number side of car dark blue color, end door header and bulkhead panels in imitation gold, stencil cross-seat front rail in imitation gold; includes: layout, stripe and cut in. Operations:

Lettering. Paint words "Interborough" on letterboards, per car	$1.10
Lettering. Paint words "Open Air Line" on side of car, per car	$1.83
Numbering. Paint four figure car, 16 numbers on side of car, per car	$0.84

Body Equipment—Exterior motor car. Clean and paint rheostat frames and hangers, contact boxes, fuse boxes, junction boxes, compressor and cradle, brake cylinder, air reservoirs, pipes, cleats, rods, clamps, asbestos, linings, truss rods, posts, needle beams and needle-beam truss rods, end caps and nuts. Operations:

Cleaning, per car	$2.352
Painting, per car	$2.898

Interior, Skinned Off Motor Car below advertisement signs. Remove varnish with remover and revarnish advertisement sign and window moldings, window cappings, pier panels, wainscotings, wire moldings at cross-seats, blind stops, cross and side seat framing and risers, end bulkhead partitions, end stationary sash, swing sash, switch boxes, cab partitions both sides, end doors, cab doors both sides, all wood trim not removed from car. Operations:

Removing varnish, bleach and sand, per car	$15.00
Varnishing. Fill, shellac, putty and varnish first coat, per car	$4.26
Varnishing. Sandpaper and varnish, second coat, per car	$1.396

Interior, Complete — Revarnished motor car. Upper deck posts, casings and sash stops, panels, deck sill and plate facia and moldings, upper and lower deck headlining, edge moldings, strap poles, advertisement sign and window moldings, window cappings, upper body side and end sash, pier panels, wainscotings, wire molding between cross-seat, cross and side seat framing, and risers, end bulkhead partitions and bulkhead panels, end stationary sash, swing sash, switch boxes, cab partitions and bulkhead panels, end stationary sash, swing sash, switch boxes, cab partitions and head panels, both sides, blind stops, partings and casings, end doors, cab door both sides, and all wood trim not removed from car. Operations:

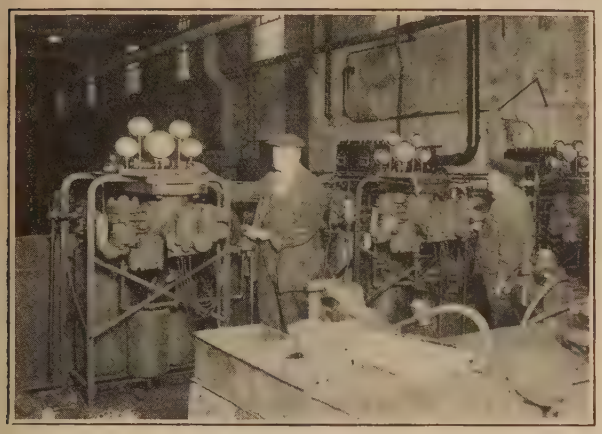
Shellacking. Sand, bleach, stain and shellac in part, per car	$1.134
Varnish. Sand and varnish, per car	$2.814

Stripping—Manhattan motor car, curtain or blind type. Strip complete as follows: Remove signal bells, bell and emergency cords, window guards and grab handles, end door locks complete with keepers, swing sash catches and keepers, cab, door locks, stile reinforcement plates, upper and lower sash, partings and frame casings, cab pocket, upper and lower drop sash, casings, partings, lifts, lock and lock stops, motorman arm rests; sash, body side upper and lower, partings, casings, lifts, locks and lock stops; blinds, partings and lifts; destination sign boxes and brackets, notice signs, fire extinguishers, emergency pipe cleats, side and cross-seat backs; stencil sash, partings and castings; place all hardware in boxes and bundle up wood trim. Strip complete including upper sash:

Motor car, 24 window curtain, per car	$2.35

Trimming—Manhattan Motor Car curtain or blind type, when not equipped with Dahlstrom posts. Trim as follows: Apply window guards, signal bells, bell cord, anchors, hooks and eyebolts, emergency cords, anchors, hooks and eyebolts, end doors, casings, locks, lock keepers, chafing plates, anti-rattlers, rubber bumpers, cab doors, locks, lock keepers, seat rests, and lock stile brace plates, cab upper and lower sashes, lifts, locks, lock stops, casings and partings, cab seats, swing sash catches and keepers, upper and lower body sashes, blinds, curtains, sash and blind lifts, partings and casings, sash locks and stops, notice signs, cross and side seat backs, fire extinguisher box complete, destination sign box and sign blade brackets, includes: fit and drill all holes, replace all broken or missing parts found on inspection. Trim complete:

Motor curtain type, 24 window, per car	$9.50



Air Brake and Brush-Holder Repairs Are Facilitated by Special Equipment
The left-hand view shows the testing department for motorman's operating air valves. The valves are tested as in regular service. At the right, a portion of the brush-holder repair department is shown

Interborough company was the first to co-operate with the manufacturers in the introduction of the rolled-steel type of wheel for heavy traction work. Since its introduction the company has carefully followed up all later developments and performances of this type of wheel in heavy traction service.

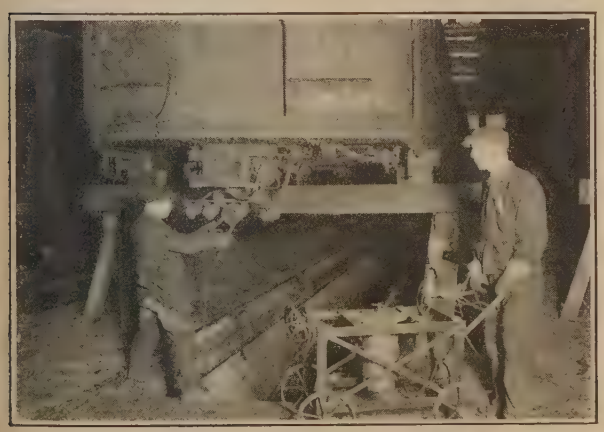
The method of turning wheels at the 147th Street shop was described in an article on page 443 of the issue of this paper for March 17, 1923, with some particulars of the piece-work system employed for practically all the repair and maintenance work of the company. The advantages of this system as a means of saving investment are perhaps no more prominently exhibited than in the work of turning wheels. Under the piece-work system the men have a strong incentive for speeding up, and the output of the lathes is correspondingly increased. The result of this is that at the 147th Street shop only three wheel lathes are required, each wheel lathe operated by one man turning out an average of 15 pairs of turned wheels per day.

Two of the charts reproduced on page 444 show the method of tabulating the number of cars shopped for wheels on the subway division and the number of flat wheels per month developed on the motor trucks and trailer trucks of the Manhattan division.

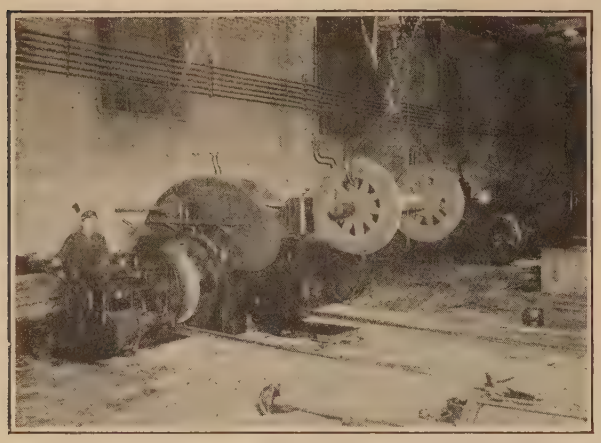
In one respect the repair situation of the company is complicated in that it has to care for the maintenance and repair of two entirely different kinds of cars, namely, wooden cars, as used on the Manhattan elevated division, and all-steel cars as used on the subway division. It is therefore in a position to be well acquainted with methods of maintenance and repair for both kinds of rolling stock and can offer to others the valuable experience it has gained in doing this work side by side with two distinct classes of equipment. While the same methods are followed in maintaining both the steel and wooden car bodies, the body repairs of each type require entirely different types of shop machinery. The steel cars are repaired at 147th Street and Lenox Avenue subway shop, which is equipped with the necessary iron-working machinery for making all classes of steel body repairs. All wooden cars are repaired at the 98th Street and Third Avenue shops, which have a full equipment of wood-working machinery.

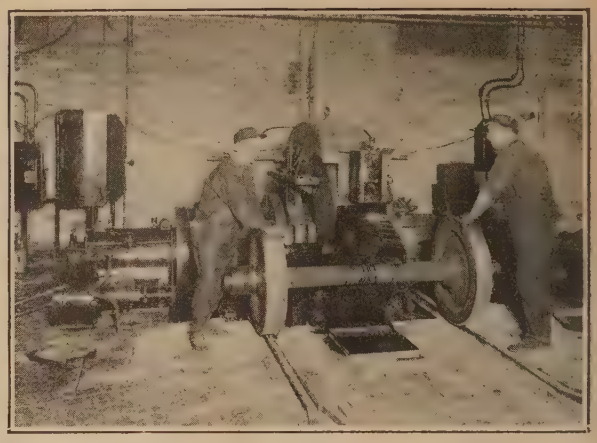
Lubrication Practice

Owing to the exacting character of the service, special attention is given on both divisions of the Interborough Rapid Transit Company to proper and adequate lubrication. The methods employed represent an extended experience of the engineers of both the Inter-



Electrical Tests for Car Wiring and Armatures Detect Open Circuits, Short Circuits and Grounds
High-tension tests on car wiring are made at 3,000 volts a.c. The convenient portable transformer outfit shown in the view at the left is used. It can be operated from a 110-volt a.c. socket. The view at the right shows the method of telephone testing armature and commutator connections to show short circuits and grounds.





Equipment for Wheel Turning at the 147th Street Shops
These powerful lathes for turning steel wheels have been of enormous help in keeping the cars used in New York rapid transit service supplied with wheels

borough Rapid Transit Company and the Galena Signal Oil Company, which has a yearly contract with the railway company for the lubrication of car equipment at a guaranteed cost per 1,000 car-miles. A typical report showing the method of tabulating the amount and cost of lubrication is that reproduced in the accompanying table, which shows the lubricant chargeable to cost per 1,000 miles during March, 1924, for the subway division.

As will be seen, the averages for the different divisions vary considerably. This variation is due largely to differences in the type of equipment used. It will also be noticed that all costs are reduced to a basis of 1,000 car-miles.

Oiling of all moving parts is done at each car inspection, which is at intervals of 1,000 miles for motor cars and 1,200 miles for trail cars, but at the end of every tenth inspection the cars receive what is known as a general oiling. At this time, the waste is removed from the motor axles and journal boxes, which are then repacked. For this packing long-strand carpet wool waste is used.

Gears are lubricated with 4 lb. of gear grease every 10,000 miles, but for every 1,000 miles the pinion ends of the armature bearing are given 2 gills of oil and the commutator end bearing 1½ gills. All armature bearings are drained every time a motor car is brought into a shop. The oil is then carefully strained through several layers of cheese cloth and is then used again for lubricating journal bearings, while the refuse is retained for greasing drawbars, brake riggings, side bearings, sector bars, etc.

As already explained a great deal of attention is given to lubrication because of the hard service which the equipment has to perform and the knowledge that adequate lubrication is one of the greatest means of reducing maintenance.

To insure proper lubrication on the road, a representative of the Galena company pays a visit at least once a month to all depots and shops, taking up with the carhouse foremen their last lubrication report and inspecting the oil housings, tanks and filters with which the various shops and carhouses are provided.

To stimulate interest in better lubrication copies of

TYPICAL MONTHLY REPORT FOR JANUARY, 1925, OF LUBRICANTS CHARGEABLE TO COST PER THOUSAND MILES, INTERBOROUGH RAPID TRANSIT COMPANY, SUBWAY DIVISION

Divisions	Motor Car Mileage	Trail Car Mileage	Total Car Mileage	Car Oil Used in Motors	Car Oil Used in Journals	Car Oil Used in Trailer Journals	Gear Grease	Comp. Oil	Total Oil, Gallons	Cost per 1,000 Miles, Motor Cars	Cost per 1,000 Miles, Trail Cars	Total Cost per 1,000 Miles	Total Cost per 1,000 Miles Previous Month	Value of Lubricants Consumed
240th St.....	2,335,394.86	1,060,948.63	3,396,343.49	Barn, 1,117	139	126	132	571	1,953	$0.19717	$0.02613	$0.14374	$0.16390	$488.18
				Shop, 563	418	85	816	38	1,104½	.11637	.01763	.08552	.11454	290.47
				1,680½	557	211	948	609	3,057½	$0.31354	$0.04376	$0.22926	$0.27844	$778.65
148th-180th St.	3,089,234.33	1,798,421.33	4,887,655.66	1,446	111	104	242	544	2,205	.16970	.01272	.11194	.11273	547.13
				738	548	151½	1,070	50	1,487½	.11530	.01853	.07970	.07697	389.53
				2,184	659	255½	1,312	594	3,692½	$0.28500	$0.03125	$0.19164	$0.18970	$936.66
Jer.-Lex.....	1,192,282.85	542,288.02	1,734,570.87	312½	30	40	11	178½	561	.11011	.01623	.08076	.08465	140.08
				301	224	46	436	20	591	.12182	.01866	.08957	.06867	155.36
				613½	254	86	447	198½	1,152	$0.23193	$0.03489	$0.17033	$0.15332	$295.44
Whitlock.....	807,855.88	374,038.80	1,181,894.68	505½	42	53	75	139½	740	.20765	.03117	.15180	.16567	179.41
				291½	216	18	422	19½	545	.17390	.01059	.12222	.13518	144.45
				797	258	71	497	159	1,285	$0.38155	$0.04176	$0.27402	$0.30085	$323.86
Queens.....	371,633.34	.....	371,633.34	72	7	7	10	95	181	.12746	.....	.13161	.12249	48.91
				49	36	...	71	3	88	.06313	.....	.06313	.08687	23.46
				121	43	7	81	98	269	$0.19059	.....	$0.19474	$0.20936	$72.37
Totals.....	7,796,401.26	3,775,696.78	11,572,098.04											

MILEAGE PER GALLON AND POUND

	Car Oil				
	Motors	Trailers	Averages	Comp. Oil	Gear Grease
240th St.....	1,044	5,028	1,387	3,835	2,463
148th-180th St...	1,087	7,039	1,577	5,201	2,355
Jer.-Lex.....	1,374	6,306	1,819	6,006	2,667
Whitlock.....	766	5,268	1,050	5,081	1,625
Queens.....	2,266	.....	3,173	2,792	4,588
Division Averages	1,088	5,993	1,484	4.701	2,373

Average cost for entire system.....$0.20800

Last months average cost for entire system.... 0.22268

ALBERT L. WESTCOTT
Service Engineer Galena Signal Oil Company

Packing Armature Bearings with New Oil-Saturated Wool Waste

the monthly reports of the lubrication expert to the superintendent of car equipment are sent to every division superintendent. At this time the superintendent of car equipment calls the attention of the division superintendents to any special points in the lubrication report which seem to call for consideration. Thus a record of an excessive amount of oil used is a reason for asking for an explanation of the conditions which brought about such a condition.

All general painting of cars is done at the 98th Street shop. Records are kept in the main office showing the date on which each car was last in the paint shop, the time when it should return to the shop if not called in earlier and the kind of painting called for.

Riveting a Roof Plate on a Car by a Pneumatic Riveter

The cars on the subway and elevated divisions are treated from a painting standpoint in an entirely different manner. The elevated cars, being very conspicuous from the street, are painted an orange color with black striping and considerable lettering. The use of so light a color is not considered necessary in the subway, so the cars on the subway division are painted a Pullman green with no lettering except the word "Interborough" on the letterboard, and the number of the car on each side at each end.

An important feature in the paint shop is the use of the piece-work system, which was adopted in 1905. Portions of the piece-work schedule for Manhattan cars are published on page 446. Other figures with typical blanks used in the shops of the company were published in the issue of this paper for March 17, 1923.

Performance Records Feature Tire Maintenance Practice

Los Angeles Motor Bus Company Is Making a Careful Study of Tire Mileage—High-Crowned Pavements Produce Uneven Wear

MAINTENANCE work on the buses of the Los Angeles Motor Bus Company, which is a subsidiary of the Los Angeles Railway and the Pacific Electric Railway, is done in a modern garage built of steel, brick and concrete. The offices of the company are on the second floor, while on the ground floor the buses are stored and repaired. In addition to storage space for 50 buses around the walls there are numerous inspection pits equipped with cranes for handling these heavy vehicles. Painting and the heaviest form of repair work are done at the railway shops.

No bus operates more than 200 miles per day. Schedule speed varies between 12 m.p.h. in the middle of the day and 7 m.p.h. in the rush hours. When a bus comes from the road it is gassed, oiled, and inspected. All lights are turned on to discover burned-out globes. Batteries and the airbrakes with which all are equipped are tested. Air in the tires is renewed every three days. Buses are greased every 500 miles and the oil changed every 1,000 miles, at which time they are taken into the pit for general inspection. After a mileage of 40,000 to 60,000 there is a general overhauling. This is practically on a yearly basis.

A record is kept of each individual tire. On every tire is burned a company number and a distinguishing letter. Thus a Moreland tire will never be used except on a Moreland bus, a Fageol except on a Fageol bus, etc. A tire numbered in the 4,000s is a 34-in. tire; one in the 5,000s a 35-in., etc.

When a tire is to be changed the mechanic fills out in duplicate a "Tire Change Blank," containing complete data. One copy he keeps; the other he sends to the storekeeper each day. Each wheel of a bus is numbered and the number of the wheel and the number of the tire must be put down on the record.

All of the data relative to tires are consolidated on permanent records which are instantly available. Any tire which has to be changed or repaired is first listed on a small file card called a "Tire Location Card." These data are then transferred to a larger filing card, which is the "Tire Record." As the mileage reading of the speedometer is taken and entered on the "Tire

Storage Space for 50 Vehicles Is Provided in the Garage of the Los Angeles Motor Bus Company as Well as Facilities for Maintenance

Record" card at each change and also the number of the wheel from which the tire was taken, the amount and kind of service given can be exactly determined.

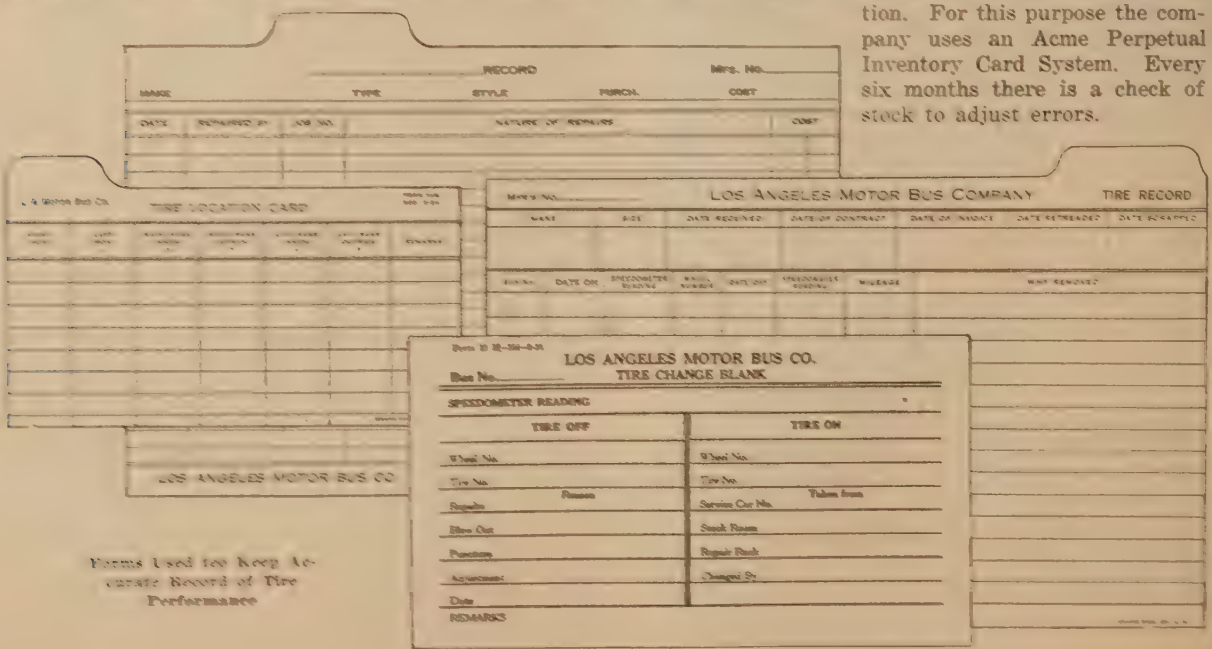
There is a special reason for recording the number of the wheel from which a damaged or wornout tire has been removed. Because of high-crowned pavements, tires used on the Los Angeles buses wear unevenly. The inside right rear tire on a bus with double rear wheels receives the hardest wear. It is estimated that these wear only 60 per cent as long as the others do. This cannot be figured closely, however, because tires are constantly being changed around to equalize the wear.

It was found after considerable experimentation that the buses rode best and tires lasted longest when unequal air pressure was used to equalize the slant of the crowned streets. With 34x7 tires the outside right and inside left tires carry ordinarily 100 lb. of pressure. The inside right and the outside left carry 90 lb.

The buses, especially the double-deckers, are hard on tires. The double-deckers tend to roll from side to side after passing over an inequality in the paving. This motion rolls the edge of the flap nad cuts the tube. A special set of tires has been made up and is now being tested by the compan. They are 12-ply instead of 10-ply and the management hopes they will solve this phase of the tire problem.

As each bus finishes its day's run and comes into the garage it is dusted and swept and minor repairs are made. The buses are washed at stated intervals. Records of these details are also kept. Not more than 15 minutes a day is required for keeping these and the tire records up to the minute. If a bus gets in trouble on the road the crew reports in and a mechanic or a tow car, depending on the degree of seriousness, is sent out. There is a "Road Trouble Sheet" for reports on breakdowns and their causes, including accidents. A 24-hour "Divisional Accident Summary" is made out for the manager's office by the dispatcher. Every accident, no matter how trivial, is personally investigated by the assistant manager in charge of operations.

All parts required for repairs are drawn on requisition. For this purpose the company uses an Acme Perpetual Inventory Card System. Every six months there is a check of stock to adjust errors.



Forms Used for Keep Accurate Record of Tire Performance

Maintenance of Armature Bearing and Housing Fits

For Efficient Operation and Long Life Sleeve Bearings Should Line Up Accurately with Armature Shafts—Bearings Loose in Housings or Housings Which Are Loose in Motor Frames Cause Misalignment, Rapid Wear and Large Oil Consumption

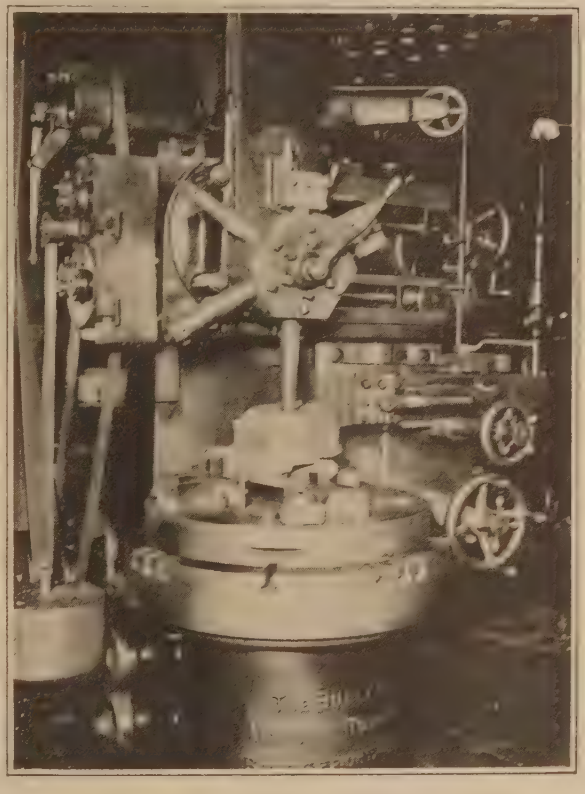
By E. F. Whitney
Renewal Parts Engineer Westinghouse Electric & Manufacturing Company

THE life obtained from armature bearings depends not only upon the lubrication and the elimination of dirt and water from the bearings but upon the ignment of the bearings, the running clearance for e shaft and the assembly of the bearings in the hous-g. Housings that are worn and are loose in the frame re liable to cause incorrect alignment of the armature earings. This trouble can best be eliminated by re-ewing the housing or by welding and remachining e housing fit. Shimming should not be permitted. t best, it is but a temporary repair and is sure to use trouble. Bearings which are shimmed to keep em tight in the housing will usually be out of align-ent, and unless the shaft journal clearance is increased veral thousandths of an inch it is quite probable that e armature shaft will bind in the bearings.

Particular attention should be given to fitting the earings to the shaft after they have been pressed into e housings. Armature bearings which are easily iven into place will loosen in service and start ex-ssive wear of the housing bore and bearing. Loose earings and excess journal clearance all tend to in-ease the oil consumption and permit destructive vibra-on of the motor parts.

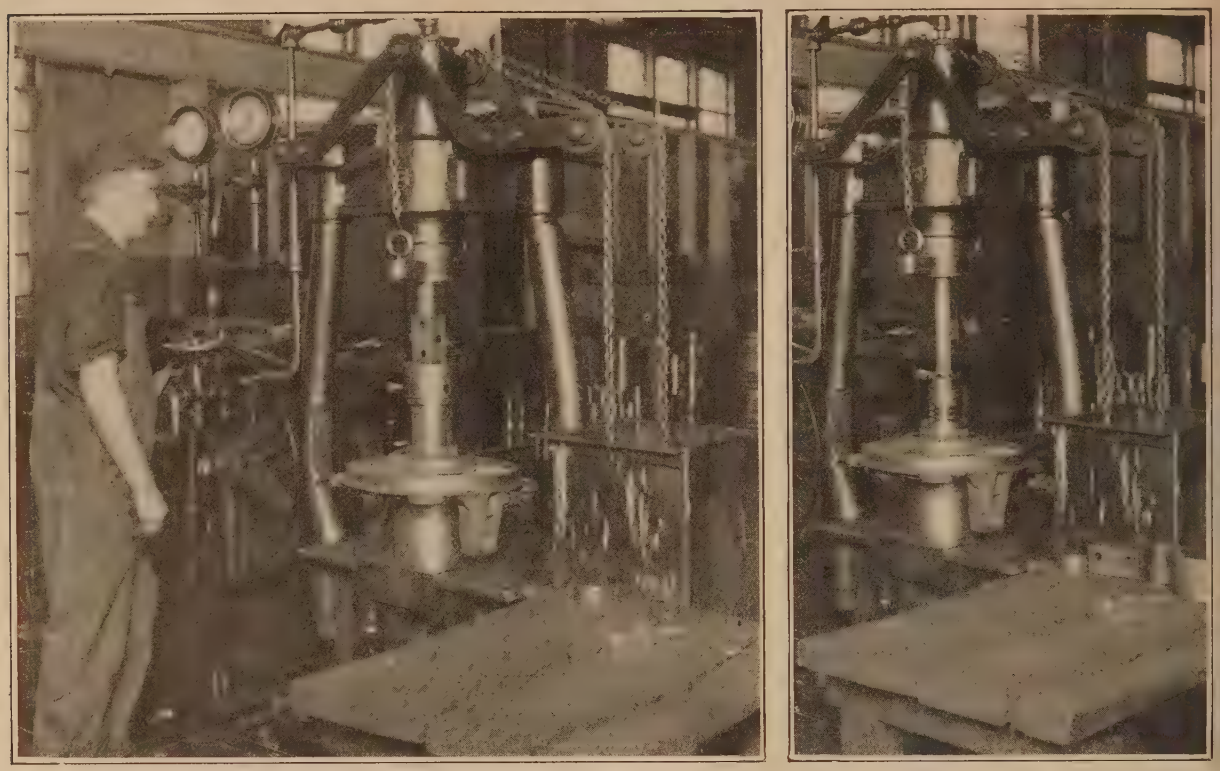
Motors of the older types usually require armature earings bored undersize for use with worn shafts. some instances bearings with the outer diameter versize are necessary if the bearings are to fit tightly the housings. Armature shaft journals will wear pered and it is desirable to turn these journals down r use with the undersized bearings. If the wear at y section of the journal reduces the diameter as much ₆₄ in. it is desirable to turn the shaft down and olish the journal so as to bring it to the nearest ndersize for which bearings are available. Some oper-ors have found it preferable to standardize the under-zed shaft journals in steps of ₃₂ in. diameter. On any other properties standardization includes only ch dimensions as ₁₆ in. and ⅛ in. undersize, as this re-uces the number of renewal bearings to be carried in ock.

Many of the older types of motors were originally uipped with cast-iron or malleable-iron babbitted earings. The babbitt lining in these bearings is thick that the armature can drop down on the pole eces in case a hot bearing occurs and the babbitt elts out. This usually results in the loss of an arma-re with considerable damage to the laminations. Bab-tted bronze bearings for the newer type motors, as ell as for the older types, are made with a thin bab-tt lining. Then if a hot bearing develops the journal ill be seated temporarily in the bronze shell, which will prevent the armature from striking the pole pieces. This feature of bronze babbitted bearings enables a crippled motor to operate in an emergency and makes possible the return of the car to the shop without excessive damage. Bronze shells can be tinned and re-babbitted more easily and satisfactorily than malleable iron or cast iron. This gives a certain assurance that longer bearing life will be obtained.



Armature Bearing Housing in Position for Boring in a Vertical Turret Lathe

The bore of the housing, or of the bearing seat in some of the older motors which do not use housings, may be worn so much as to require a bearing with a larger outside diameter than the standard bearing. If the housing bore can be welded satisfactorily so as to avoid distortion or imperfect alignment it may be re-machined to standard size. Housings which are worn only three or four thousandths in the bore can be fitted with slightly oversize bearings. If the wear amounts to several thousandths, the housing should be rebored



At Left—Pressing Bearing into Housing with Bearing Press. At Right—The Same Press Is Used for Broaching the Bearing Surface

for an oversize bearing, built up by welding and remachined to standard size or a new housing should be obtained. Housings of light construction, unless they are of steel, should not be weakened by reboring more than $\frac{1}{8}$ in. diameter oversize. Heavy housings with thick hub sections can safely be rebored $\frac{1}{8}$ in. larger in diameter.

The reboring of the housing can be done best in a vertical turret lathe such as shown in an accompanying illustration. The housing must be centered from its outside rim and the axis of the boring bar must line up with the center line of the housing bore. The set-up for box frame motor housings can best be made by attaching a false jaw of soft steel to each of the four chuck jaws. These jaws are then bored and faced off on top to form supports for the rim of the housing similar to the housing seat of the motor frame. With the housing clamped in the lathe a light cut should be taken in the bore. Then it should be finished to exact size. Special attention should be given to make the bore smooth and within a variation of plus or minus 0.001 in., so that a lasting press fit of the housing may be obtained. The original keyway, if worn, should be welded before reboring and recut for the standard key after the housing has been rebored.

The outside diameter of the armature bearing should have a press fit allowance of plus 0.002 to 0.004 in. Its surface should be smooth and free of any ridges or tool marks. Large bearings may be given a coating of white lead on the outside, but with the smaller ones ordinary machine oil could be used when pressing the bearing into the housing.

A type of bearing press such as shown in one of the illustrations will give satisfactory results. The hydraulic type, operating with a plunger speed of 8 to 10 in. per minute, is more desirable than a faster hydraulic type of press or the air cylinder type. The bearing should be started into the housing by driving it with a flat plate, after which 3 to 5 tons pressure should be applied. With large bearings about 5 to 8 tons pressure will be required at the final instant.

Babbitted armature bearings after they have been pressed into the housing will be closed in so as slightly to reduce the bore. It is therefore necessary to broach the bearing to make it the desired size. A broach of the type shown is very satisfactory. The broach should have from six to nine annular teeth, ground to different diameters, varying by increments of 0.002 in. The maximum size of the broach should be from eight to fourteen thousandths larger than the shaft diameter, depending upon the journal size. One very desirable feature of broached bearings is the polished surface of the babbitt which the broach leaves as it cuts its way through the babbitted bore.

The table below shows the maximum and minimum running clearance for the journal for shafts of various sizes:

ALLOWABLE RUNNING CLEARANCE FOR JOURNAL BEARINGS, IN INCHES

Shaft Diameter	Clearance for Journal	
	Maximum	Minimum
2 to 3	0.008	0.006
3 to 4	0.010	0.007
4 to 5	0.014	0.008

With larger motors it is desirable to keep closer clearances and exact alignment. The armature bearings of such motors, after being pressed into the housings, should be finish-bored instead of being broached to size. If broaches are not available for the smaller bearings, then these bearings should be rebored after they are assembled in the housing, in order to obtain the required clearance. The set-up for this operation would

be the same as that made if the housings were to be rebored in the vertical turret lathe.

The sides of the waste window of the bearing should be rounded or beveled and oil grooves should be cut from the corners of the window to permit the lubrication of the flange end by the oil collected in the chamfer at the side of the waste window. The groove should be cut through to the face of the flange to lubricate the wiper face and the bearing flange.

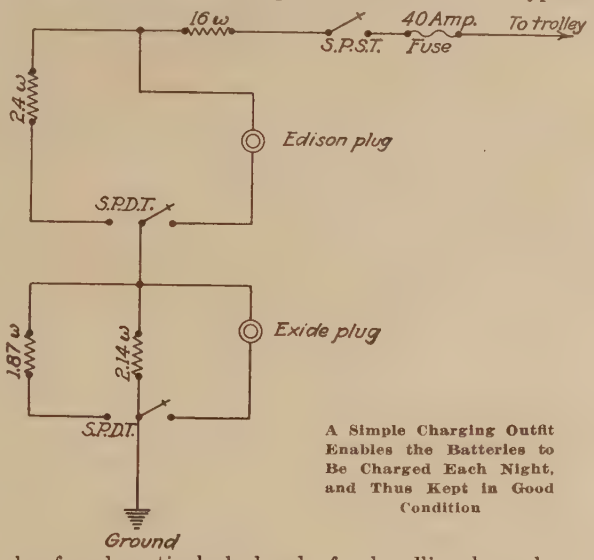
It is necessary in following out this bearing renewal procedure to have both the pinion end and commutator end housings accompany the armature to the winding room and bearing department where the shaft journals would be calipered and, if worn, turned to a standard undersize. The bearings would then be pressed into the housings and the bores either broached or machined in the vertical turret lathe to give a uniform bore concentric with the housing seat. The armature with its housings would then be returned to the assembly floor, where the complete motor would be assembled and tested before being put into service.

Storage Battery Trucks Save Time and Labor

Kansas City Railways Uses Two of These Trucks and Finds Them Valuable for Handling a Large Variety of Railway Parts and Materials

TWO storage battery trucks which have been used in the shops of the Kansas City Railways for some time have paid valuable returns in the form of savings in labor and time for handling the miscellaneous varieties of materials that must be moved about the shop. This equipment is used for handling such materials between the various shop departments, between the shop and the storeroom, and also for loading the supply cars that transport materials and parts to the various carhouses.

One of the trucks is of the fixed-platform type and the other has an elevating platform. The former is the older of the two. Since this has a larger platform than the other, it has been equipped with special racks for carrying such car parts as mounted wheels, motor cases, etc. Tiers of boxes containing finished parts going from the shop to the storeroom are readily handled on the elevating platform truck. This type is also found particularly handy for handling large boxes or containers filled with parts.



A Simple Charging Outfit Enables the Batteries to Be Charged Each Night, and Thus Kept in Good Condition

Charging equipment has been set up as shown in the accompanying diagram. This consists of a rheostat for regulating the rate of charge and instruments for measuring the current and voltage. It is the practice to test the batteries each evening. They are then plugged into the charging line, and the night watchman has instructions to take them off some time during the night, or whenever they are completely charged.

The trucks are manned by an operator and helper. These men replace a number of laborers who were formerly required for moving materials about the shop on hand trucks.

These Storage-Battery Trucks in the Shops of the Kansas City Railways Are Found Very Valuable for Moving Materials About the Shops

Standard Forms for Shop Reports

By Keeping Equipment Maintenance Records in a Uniform Manner, Electric Railways in the Texas District Are Able to Compare Performance Results and Costs with Each Other and Decide Where Improvements Are Needed

FOR many years the master mechanics of the various electric railways in the Texas district under the Stone & Webster management have made monthly and yearly reports of their departmental work. These reports for the mechanical department gave performance statistics of various kinds, such as wheel mileage, trolley shoe and wheel data, lubrication costs, and various other information. When first started, the master mechanic of each company would compile these data for his company in any form he saw fit, and in greater or less detail, according to his fancy. This method had the disadvantage that the information given was not comparable with the reports of the mechanical departments of other companies under Stone & Webster management in the Texas district, because the methods of computation in each case were different.

The master mechanic of the Northern Texas Traction Company wished to compare his performance with that of other mechanical departments on the same basis, so he prepared several standard forms of shop reports. These have now been adopted as standard by the other Stone & Webster properties in the Texas district. Beginning with Jan. 1, 1924, all mechanical department monthly and annual reports were made out on these forms. This has served to stimulate interest among the master mechanics, and extreme competition within certain limits has resulted.

There are 19 report forms used, which are listed as follows: (1) Car Changes; (2) Pairs of Car Wheels Changed; (3) Car Wheels Discarded; (4) Armature Changes; (5) Average Miles Between Armature Rewinds; (6) Car Painting Costs; (7) Car Overhauling Costs; (8) Car-Miles; (9) Lubrication; (10) Brake Shoe Cost per Thousand Car-Miles; (11) Trolley Wheel Cost per Thousand Car-Miles; (12) Trolley Slide Cost per Thousand Car-Miles; (13) Total Current Collection Equipment Cost per Thousand Car-Miles; (14) Maintenance Cost per Thousand Car-Miles; (15) Total Cost of Carhouse Operation; (16) Number of Cars Washed; (17) Number of Cars Inspected; (18) Wrecker Calls; (19) Labor Turnover.

These reports are arranged to give data in a uniform manner regarding performance, costs, etc., for the current year or month, together with similar figures for the corresponding period a year previous. This permits easy comparison with former records.

For the convenience of the various companies comprising the Texas district and also for local information of the individual companies, the various subdivisions of power accounts are divided into additional classifications from that contained in the standard classification. A special form is also used for operating expense accounts for the railway. This form is reproduced herewith.

1. *Car Changes.* The form for car changes is made out monthly and includes a list of the principal changes made, such as car body, fenders, glass out, trucks, hot journals, brakes, air equipment, motors, control equipment, trolleys, wiring, accidents, and service changes. Two columns are arranged to tabulate information for each of these items, one for the current month and the other for the corresponding month of the previous year. A summary is given at the bottom of the form which includes the total average miles, car changes for the mechanical department and other departments, and the average miles per change for the mechanical department and for other departments. This information is also tabulated to give comparison for the current and previous year.

2. *Pairs of Car Wheels Changed.* The report of car wheels changed is made out monthly for all divisions. On this form the various defects which cause wheels to be removed are listed in separate columns for each diameter of wheel used. Monthly totals are given for the current and corresponding month of the previous year. The various defects listed are skidded flat, worn flat, flanges, journals, worn-out wheels, manufacturing defects, miscellaneous. Totals are given for the current and previous year.

3. *Car Wheels Discarded.* The form for car wheels discarded contains seven columns with headings as follows: Type, size, number of wheels, total life mileage this year, average mileage this year, number of wheels last year, average mileage last year.

4. *Armature Changes.* Information regarding armature changes is made out monthly and includes side headings of open circuit, shorted coils, grounded, commutators, loose bands, broken shaft, pinions, sleeve bearings, ball bearings, melted babbitt, and miscellaneous. Totals are given for the current month and corresponding month of previous year, together with the average mileage per change.

5. *Average Miles Between Armature Rewinds.* Information regarding the average miles between armature rewinds is tabulated monthly on a form with the following headings: Class, number in service this year, number rewound this year, per cent rewound, average miles, number in service last year, number rewound last year, per cent rewound last year, and average miles last year.

6. *Cars Painted.* Information regarding cars painted is tabulated for two classes, so as to give the number and average cost. The information is tabulated for the current and previous years. The various types of cars are listed and are divided according to service into city or interurban. A summary at the bottom gives the total number of cars painted.

7. *Cars Overhauled.* The form for cars overhauled is quite similar to that for cars painted and divides them into two classes, with the number and average cost. The cars are also listed according to type and service.

8. *Car-Miles.* This information is tabulated under three headings for the current year and for the previous year, so as to give the number of cars owned, the average miles per car and total miles operated. Cars are classified according to type and number of motors, and summaries are given for total miles of two-man cars, convertible safety cars, all types of city cars, all types of interurban cars, and totals for each company and for the entire system.

9. *Lubrication.* This information is tabulated so as to give the gallons or pounds of lubricant used, the total cost and the cost per 1,000 car-miles. Classification is made by divisions, and the various kinds of lubricants listed include car oil, air compressor oil, cup grease, gear lubricant, and other lubricants. A summary at the bottom of the sheet gives the total cost of lubricants for all divisions; the cost of packing, waste, etc.; cost of labor for lubricating cars; total cost of lubricating, including both labor and material, and the total cost per 1,000 car-miles.

10. *Brakeshoe Costs per 1,000 Car-Miles.* Information regarding brakeshoe costs is tabulated monthly and gives amounts for the current year and for the previous year. This is arranged by divisions and includes the

total cost of shoes, total number of shoes, and the cost per 1,000 car-miles.

11. *Trolley Wheel Costs per 1,000 Car-Miles.* The information for trolley costs is tabulated in a manner quite similar to that of brakeshoe costs, and is divided into divisions with separate places for total cost of wheels, total number of wheels, average car-miles per wheel, and cost per 1,000 car-miles.

12. *Trolley Slide Costs per 1,000 Car-Miles.* The tabulation for trolley slide costs is also quite similar to that of 10 and 11 and is divided into divisions with headings for total cost of slides, total number of slides, average car-miles per slide, and cost per 1,000 car-miles.

13. *Total Current Collection Equipment Cost per 1,000 Car-Miles.* Information for the total cost of current collection equipment is tabulated for the various divisions and includes the total cost of collection equipment with the total cost per 1,000 car-miles.

14. *Maintenance Cost per 1,000 Car-Miles.* This information is tabulated

Types of Forms Used in Recording Equipment Repairs and Changes by Texas Traction Properties

FINANCIAL REPORT — **OPERATING EXPENSE ACCOUNTS - RAILWAY**

CO.

	PER CAR MILE (CENTS) THIS YEAR	PER CAR MILE (CENTS) LAST YEAR	FOR MONTH OF CURRENT YEAR	FOR MONTH OF PREVIOUS YEAR	FOR MONTHS CURRENT YEAR	FOR MONTHS PREVIOUS YEAR
BUILDINGS, FIXTURES & GROUNDS						
24.1 CAR HOUSES & SHOPS						
24.2 STATIONS & WAITING ROOMS						
24.3 OTHER BUILDINGS, FIXTURES & GROUNDS						
24.4						
TOTAL BUILDINGS, FIXTURES & GROUNDS						
PASSENGER & COMBINATION CARS						
30.1 CAR BODIES						
30.2 PAINTING CAR BODIES						
30.3 TRUCKS						
30.4 WHEELS						
30.5 AIR COMPRESSORS						
30.6 OTHER AIR EQUIPMENT						
30.7 FARE REGISTERING DEVICES						
30.8						
TOTAL PASSENGER & COMBINATION CARS						
FREIGHT, EXPRESS & MAIL CARS						
31.1 CAR BODIES						
31.2 PAINTING CAR BODIES						
31.3 TRUCKS						
31.4 WHEELS						
31.5 AIR COMPRESSORS						
31.6 OTHER AIR EQUIPMENT						
31.7						
TOTAL FREIGHT, EXPRESS & MAIL CARS						
SERVICE CARS						
32.1 CAR BODIES						
32.2 PAINTING CAR BODIES						
32.3 TRUCKS						
32.4 WHEELS						
32.5 AIR COMPRESSORS						
32.6 OTHER AIR EQUIPMENT						
32.7						
TOTAL SERVICE CARS						
ELECTRIC EQUIPMENT OF CARS						
33.11 PASSENGER CAR MOTORS						
33.12 EXPRESS CAR MOTORS						
33.13 SERVICE CAR MOTORS						
33.2 CONTROL APPARATUS						
33.3 COLLECTING APPARATUS						
33.4 POWER SAVING DEVICES						
33.5 OTHER ELECTRICAL EQUIPMENT						
33.6						
TOTAL ELECTRIC EQUIPMENT OF CARS						
MISCELLANEOUS CAR SERVICE EXPENSES						
67.1 CAR LUBRICANTS						
67.2 PACKING & WASTE FOR CAR LUBRICANTS						
67.3 CAR CLEANING MATERIALS						
67.4 TROLLEY ROPES, FUSES, LAMPS, ETC.						
67.5						
67.6 CONDUCTORS' PUNCHES, BADGES, ETC.						
67.7 OTHER CAR SERVICE EXPENSES						
67.9						
TOTAL MISC. CAR SERVICE EXPENSES						
CAR HOUSE EMPLOYEES						
70.1 LABOR—CLEANING & WASHING CARS						
70.2 LABOR—OILING & GREASING CARS						
70.3 LABOR—INSPECTION OF CARS & EQUIPMENT						
70.4 OTHER CAR HOUSE LABOR						
70.5						
TOTAL CAR HOUSE EMPLOYEES						

Cars Painted

Month of 19 SECTION NO. 6

	THIS YEAR Class No. 1 No.	THIS YEAR Class No. 1 Ave. Cost	THIS YEAR Class No. 2 No.	THIS YEAR Class No. 2 Ave. Cost	LAST YEAR Class No. 1 No.	LAST YEAR Class No. 1 Ave. Cost	LAST YEAR Class No. 2 No.	LAST YEAR Class No. 2 Ave. Cost
City D.T. Cars								
" S.T. Cars								
" D.T. Std. Safety Cars								
" S.T. " " "								
" Service Cars								
Int. Motor Pass. Cars								
" Pass. Trail "								
" Express Cars								
" Service Cars								
T.C.T. Co. Pass. Cars								
" Express Cars								
Total No. of Cars Painted								

Car-Miles

Month of , 19 SECTION NO. 8

TYPE OF CARS	THIS YEAR No. Cars Owned	THIS YEAR Av. Mi. Per Car	THIS YEAR Total Miles	LAST YEAR No. Cars Owned	LAST YEAR Av. Mi. Per Car	LAST YEAR Total Miles
City 4 Motor D.T. Cars						
" 2 " D.T. "						
" 2 " S.T. "						
Total Miles—Two Man Cars						
City 4 Motor D.T. Conv. Saf. Car						
" 2 " D.T. " " "						
" 2 " S.T. " " "						
Total Miles Conv. Saf. Cars						
City 4 Mtr. D.T. Std. Saf. Cars						
" 2 " S.T. " "						
Total Miles—Std. Saf. Cars						
City Service Cars						
Total—All Types City Cars						
Int. 4 Mtr. D.T. Pass. Cars						
" 2 " D.T " Trailers						
" 4 " D.T. Express Cars						
" 4 " D.T. Service Cars						
" Pass. Trailers (No Mtr.)						
Total—All Types Int. Cars						
Total Miles—N.T.T. Co.						
T.C.T. Co. 4 Mtr. D.T. Pass. Cars						
" 4 " D.T. Exp. "						
Total Miles—T.C.T. Co.						
Total Miles—Entire System						

Car Changes

Month of , 19 SECTION NO. 4

	THIS YEAR	LAST YEAR
Car Body		
Fenders		
Glass Out		
Trucks		
Hot Journals		
Brakes		
Air Equipment		
Motors		
Control Equipment		
Trolleys—Wiring		
Accidents		
Service Changes		
Total		
Average Miles		
Car Changes—Mech. Dept.		
" " Other "		
Ave. Miles per Change, Mech. Dept.		
Ave. Miles per Change, Other Dept.		

Lubrication

Month of , 19 SECTION NO. 9

KIND OF LUBRICANT	GALS. OR LBS. AMOUNT USED 19	GALS. OR LBS. AMOUNT USED 19	TOTAL COST 19	TOTAL COST 19	COST PER MCM 19	COST PER MCM 19
FORT WORTH DIVISION						
Car Oil						
Air Comp. Oil						
Cup Grease						
Gear Lubricant						
Other Lubricants						
TOTALS						
INTERURBAN DIVISION						
Car Oil						
Air Comp. Oil						
Cup Grease						
Gear Lubricant						
Other Lubricants						
TOTALS						
T.C.T. Co. DIVISION						
Car Oil						
Air Comp. Oil						
Cup Grease						
Gear Lubricant						
Other Lubricants						
TOTALS						
ALL DIVISIONS						
Car Oil						
Air Comp. Oil						
Cup Grease						
Gear Lubricant						
Other Lubricants						
TOTALS						
Total Cost of Lubricants (All Divisions)						
Cost of Packing, Waste, etc.						
Cost of Labor for Lubricating Cars						
Total Cost of Lubricating (Labor and Mater ial)						
Cost Per M.C.M.						

Armature Changes

Month of 19 SECTION NO.

	THIS YEAR	LAST YEAR
Open Circuit		
Shorted Coils		
Grounded		
Commutators		
Loose Bands		
Broken Shaft		
Pinions		
Sleeve Bearings		
Ball Bearings		
Melted Babbitt		
Miscellaneous		
Total		
Average Miles Per Change		

Pairs of Car Wheels Changed

Month of , 19 SECTION NO. 7

ALL DIVISIONS

	21"	22"	24"	26"	30"	33"	34"	36"	37"	This Yr. Tot.	Last Yr. Tot.
Skidded Flat											
Worn Flat											
Flanges											
Journals											
Worn Out Wheels											
Mfg. Defects											
Miscellaneous											
Total This Year											
Total Last Year											

monthly and contains columns for total cost and cost per 1,000 car-miles for the current and previous year. The various types of cars are listed and divided into city and interurban classes. A summary is given for all cars.

15. *Total Cost of Carhouse Operation.* The cost of carhouse operation is arranged to show comparative figures for the current and previous year under the headings of cost of carhouse operation, cost per 1,000 car-miles, cost of inspecting cars, cost per 1,000 car-miles for inspection, cost of cleaning cars, cost per 1,000 car-miles for cleaning.

16. *Number of Cars Washed.* The information tabulated for the number of cars washed gives only the number of the city and interurban cars washed for the particular periods.

17. *Number of Cars Inspected.* Information regarding cars inspected is given for regular and light inspection and includes the number of city and interurban cars inspected in each class.

18. *Wrecker Calls.* Information regarding wrecker calls is tabulated for the current and previous year under the headings of fires, car failures, derailments, obstructions on track, collisions, and miscellaneous. Totals are given for corresponding periods each year.

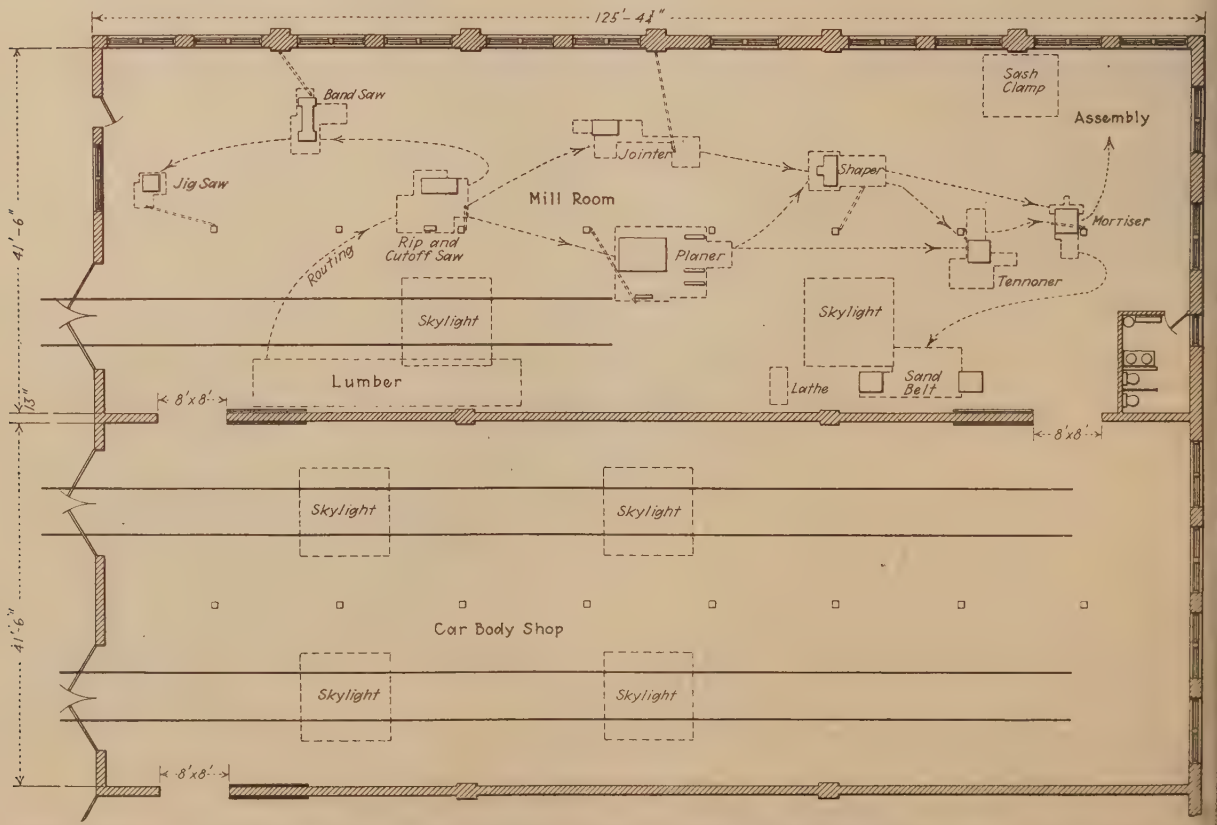
19. *Labor Turnover.* Information regarding labor turnover is tabulated under the headings of number of regular men hired, number of extra men who left service, number of regular men who left service, number of extra men hired, and number of regular men in service.

Carhouse Converted into a Shop

Ample Space Was Available and Individual Motor-Driven Tools Were Located to Facilitate Direct Routing of Work in Columbus, Ohio

TWO sections of an old carhouse of the Columbus Railway, Power & Light Company were taken over recently by the shops department after the company disposed of its summer cars. Each section is 41 ft. 6 in. wide and 123 ft. 4¾ in. long. One is used as a mill room and the other as a car body repair shop. Tracks were left in the body repair section and a plank floor laid even with the top of the rails. The mill room section of the building has an outside side wall with eleven large windows in it. Skylights have been placed in the roof of both rooms. Two are located over each track in the car body repair shop and two are located in the mill room near the partition between the two sections. Combined with the white-painted walls and ceilings these make the room especially light and attractive during the daytime.

Artificial illumination is furnished in the mill room by three rows of 100-watt, 110-volt lamps in dome reflectors mounted about 12 ft. above the floor. This height and the spacing give uniform illumination on the floor without wasting light. In the car body repair shop a row of dome reflectors has been placed adjacent to the roof-supporting columns. In addition, rows of 150-watt lamps with scoop-shaped reflectors along two side walls throw the light against the car. Each lamp has an individual snap switch on a drop cord.



General Layout of Woodworking Machines Which Expedites Routing of Material Through Mill Room Into Car Body Repair Shop

New Mill Room of Columbus Railway, Power & Light Company Was Formerly Part of an Old Carhouse

Car Body Repair Room, Adjacent to the Mill Room, Is Large Enough to Accommodate Four Cars

Because generous floor space was available, the various wood-working machines have been spaced so that there is ample room around every one. As each machine is driven by an individual motor, it was possible so to place them that the best routing of material through the shop was obtained. A short length of track enters the mill room at one corner. The rough lumber is brought in on flat cars and placed between the track and the wall. On the other side of the track is located the combination rip and cut-off saw, while immediately in line with this is the planer and jointer. Following in line toward the rear of the room are the shaper, tenoner, mortiser and sanding machine. Specialized and curved work is taken care of by a band saw and a jig saw located at the front of the shop somewhat out of line with the other machines. Assembly of sashes and doors takes place in the rear corner of the room, where clamps, gluepot and assembly benches are provided. The finished product is taken through the doorway at the rear or front end of the shop into the car body repair shop, or on into the mill work storeroom.

All Motor Repairs Made at Shop

By R. S. Neal
Assistant Superintendent of Equipment
Kansas City Railways

FOR some time it has been the practice of the Kansas City Railways to make no motor repairs at the carhouses. Regardless of what the failure may be, the entire motor is removed from the truck and is sent to the shops.

It is felt that there is considerable advantage to be gained from this practice, as the shop is better qualified and equipped to take care of the various motor repair jobs than are the carhouse forces. More uniform results and a higher degree of workmanship in fitting armature and axle bearings and similar classes of work are obtained where this work is carried out by a comparatively small number of highly trained specialists under the direct supervision of the shop management. Armatures are handled to better advantage than in the carhouses and there is consequently less possibility of serious damage to this expensive equipment when it is being put into the motor case. Heretofore it was the practice to move armatures back and forth between the shop and the carhouses on a car specially equipped for this purpose. In spite of these precautions, however, there is no doubt that considerable damage was done in handling them.

Another important motor maintenance practice which has cut down the number of failures in service and has reduced repair costs is the elimination of field coil terminals. This, of course, has been largely made possible by concentrating all the motor repair work at the shop. The leads are brought out directly from the field coils and permanently joined together. This practice is being followed on GE-67, GE-70, GE-80, and West.-306 motors. On box-frame motors this form of installation is not entirely satisfactory, but it is planned to extend the practice to that type of construction when a special machine, now under consideration, for making the installation is completed. On the GE-57 type of motor it is at present almost impossible to handle several coils connected together on account of the excessive weight. At the present time, however, the brass field coil spools in these motors are being removed, and the coils are being made up similar to those on other types of equipment. It is expected that this construction will make it practicable to connect the coils together and eliminate the terminals.

A very important advantage is obtained from the practice of making all motor repairs at the shops, in the matter of field coil maintenance. When the motor work is done at carhouses, certain types of field coil defects are very difficult to detect. Unless some very serious defect develops, which shows up in flashing or burning of the armature, there is a strong tendency to allow motors to continue in service until serious damage occurs. When motors are sent in to the shop for routine bearing, gear and armature maintenance, a much more careful and thorough check of the condition of field coils is possible. The saving in this one item alone probably more than justifies the practice of sending the complete motors to the shop.

Investigation has shown that there is very little if any increased cost for labor and handling due to sending in the complete motors. This is particularly true of box-frame motors. The results of the practice in Kansas City have been so satisfactory from the standpoint of reducing failures in service that it is considered an important improvement.

Keeping Down Line Maintenance Costs on a Small Interurban

A 1-Ton Ford Truck Equipped with Extension Ladders Is Used as a Line Wagon

On the New Haven & Shore Line Railway a Few Skilled Men Divide Their Time Between Repair Work on the Overhead Structure and on the Rolling Stock and Track — A Gasoline-Propelled Line Car Is Used —Catenary Construction Reduces Maintenance Expense

Trouble Hunting on Private Right-of-Way Is Done with a Gasoline-Propelled Rail Car and Trailer

DURING the year and eight months since service was resumed on the New Haven & Shore Line Railway, Guilford, Conn., careful attention has been given by William Walker, general manager, to every means of reducing operating expense. This has resulted in keeping down the cost to an average of 20.03 cents per car-mile in 1924. Of this, 2.27 cents was for maintenance of way and structures, including overhead lines. It is estimated that only about one-third of the latter amount, or somewhat less than 1 cent per car-mile, is chargeable to maintenance of the overhead construction. A total of less than $1,000 has been spent for this purpose during the entire period since the railway was reorganized in 1923.

A detailed account of the way in which the reorganization was accomplished was published in ELECTRIC RAILWAY JOURNAL for Sept. 6, 1924, page 343. Certain changes which were made in the methods and equipment used for power generation and distribution have had an important influence in reducing the cost of operation.

ORIGINAL DESIGN WAS FOR 1,200 VOLTS

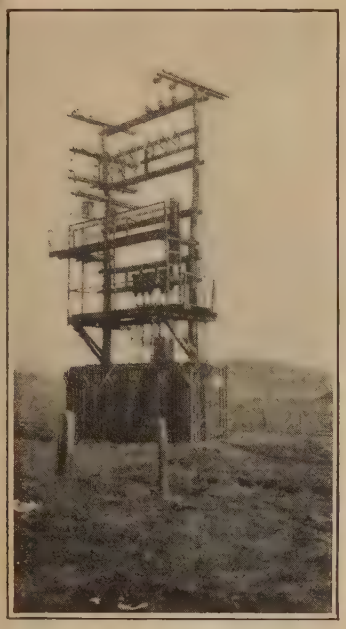
The road was originally built in 1910 to operate at 1,200 volts, d.c. Power was generated by 25-cycle, three-phase Curtis turbines at the company's own station at Saybrook, the eastern terminus of the line. At this point there was also a substation equipped with three General Electric 600-volt, 200-kw. rotary converters. Two of these were operated in series to furnish power at 1,200 volts. The third machine was a spare. Later a fourth was added, which made it possible to operate two sets when desired.

At Guilford, 18 miles from Saybrook and 16 miles from the western terminus of the line at New Haven, a second substation was located. Equipment similar to that at Saybrook was used. Between these places there was a high-tension transmission line and from Guilford to Foxon Park, on the outskirts of New Haven, there was a 500,000-circ.mil feeder line.

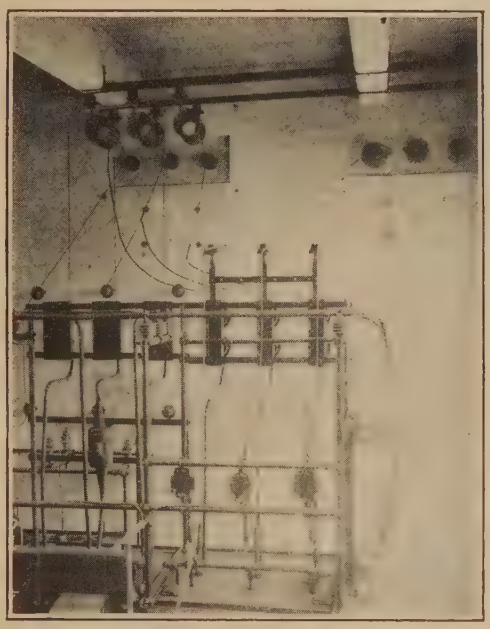
Overhead construction was of the three-point catenary type, designed by the General Electric Company and the Sperry Engineering Company. The latter company was also the builder of the line, including tracks, overhead structures, buildings, etc. Present low maintenance costs are made possible largely by the quality of the original construction. A seven-strand steel messenger wire was used with No. 000 grooved copper trolley wire. These were suspended from bracket arms on wood poles spaced 150 ft. apart. All the smaller parts used in the overhead structure were sherardized instead of being galvanized. The latter process was used only for such pieces as bracket arms, which were too large for sherardizing treatment. The material so treated has stood up well during the intervening years despite the corrosive effect of the salt air which is always present along the shore of Long Island Sound.

Originally cars weighing nearly 60,000 lb. were operated by four 600-volt motors connected two in series. In the city of New Haven the Shore Line cars operated over the tracks of the Connecticut Company, where the trolley voltage was only 600. In the beginning this was done without changing the motor connections so that they ran at half speed, resulting in extremely slow operation. Commutating switches were installed at a later date to permit operating the motors in parallel.

In 1919 all service on this railway was suspended, as told in the article already referred to. This condition continued until the summer of 1923, when,



At Left — Where Purchased Power Is Metered the Automatic Oil Switch Is Protected by Two Sets of Fuses. This Cut-Out Switch Can Be Reset from the Power Station, 3 Miles Away



Center—The High-Tension Line Is Brought Into the Guilford Substation as Shown Here. An Automatic Oil Switch Has Been Installed at This Location

At Right—Messenger and Trolley Wires Are Suspended from Bracket Arms. The Transmission Line Is Carried on Cross-Arms at the Top of the Poles

despite many handicaps and discouragements, a reorganization was effected under the auspices of F. E. Kington & Company, bankers of New Haven. Twenty months ago service was resumed after an interruption lasting almost four years.

Changes for 600-Volt Power Supply

At this time extensive changes were made in the rolling stock and methods of power distribution. It was decided to operate at 600 volts instead of 1,200 volts. New substations were built at Totoket, half way between Guilford and New Haven, and at Grove Beach, 6 miles from the eastern end of the line. These were equipped with two rotary converters each, taken from the Saybrook substation, which was discontinued. After four years of idleness these machines were put back in service after being subjected to only a short drying out process. This was all that was needed, however, and little trouble has been experienced with them.

It was arranged to purchase power from the Connecticut Company at New Haven instead of generating it at Saybrook. Connection is made at a point about three-quarters of a mile beyond the beginning of the Shore Line tracks. An 11,000-volt, three-phase, 25-cycle transmission line is connected through a set of fuses and an automatic oil cut-out switch to a recording wattmeter. From there it goes through a second set of fuses to the transmission circuits of the Shore Line Railway. An interesting feature of this installation is that the oil switch can be reset from the Connecticut Company's power house, 3 miles away. Otherwise it would be necessary for a man to make the long trip from Guilford to reset it. The arrangement of the equipment is shown in an accompanying illustration.

This Three-Point Catenary Construction Has Been a Factor in Keeping Down Line Maintenance Cost. On Curves Wood Strain Insulators Are Used in the Manner Shown

A new transmission line was built from New Haven to Guilford. From that point to the new substation at Grove Beach it was possible to make use of the old line. An automatic oil switch has been installed inside the Guilford substation. This is set lower than the one at New Haven, so that the former will trip out first in case of overload and perhaps save the latter from tripping out at all. Its present location inside the substation is convenient for resetting. Formerly protection was afforded only by fuses mounted outdoors on a pole. Altogether, approximately 24 miles of 11,000-volt line is now maintained by the railway.

These arrangements for power distribution have worked out entirely satisfactorily. Last summer, when traffic was at its height, the railway was operating four regular passenger cars, two or sometimes three extra passenger cars, five stone cars and a work car. Despite these heavy demands no trouble has been experienced with low voltage. During the winter it is possible to shut down the Totoket substation.

In addition to the transmission lines, the railway

A Typical Telephone Station on the Shore Line Railway. All Train Movements Are Regulated by Telephone. No Signals Are Used

has 2 miles of private telephone lines and 20 instruments. All train dispatching is done by telephone. Special train movements are arranged by the dispatcher when necessary. There are no signals.

Except for the changes mentioned in the foregoing paragraphs, the overhead construction is the same today as when the railway was originally built. The messenger wire, braces and pull-offs are in good condition. Wood strain insulators used on curves have stood up well. The copper trolley is somewhat worn in places, but not to an extent that seriously affects its usefulness. It is planned in the future to use clinch ears at certain locations where the groove is now rather badly worn.

The good condition of the trolley wire is the more remarkable because the old cars for a time were equipped with cast-iron trolley wheels. These were found to be so injurious to the copper trolley wire, however, that their use was eventually discontinued. The present cars are equipped with More-Jones type VK 6-in. copper trolley wheels. These have been found to have an average life of 4,210 miles. Whenever conditions require it sleet cutters of a type made by the Connecticut Company are used. This has been necessary but a few times during the past two years.

Catenary construction has been a factor in keeping the cost of line maintenance low. There is no quick change from a comparatively slack wire midway between poles to a rigid section directly under the bracket arm as with direct suspension. Cars are operated at speeds of 35 to 40 m.p.h. on private right-of-way and the wire has shown no sign of excessive wear. Few breaks have occurred and there has been no indication of crystallization.

The maintenance personnel of the Shore Line Railway has varied duties. Two men are regularly engaged on track repairs, greasing curves, oiling switches, etc. Two other men divide their time between maintaining the overhead lines and substations, inspecting and overhauling cars, and bonding, repairing bridges, etc. Two days each week are ordinarily devoted to each of these three occupations. On Sunday the four regular men are off and a fifth serves as all-around emergency man. The men are paid well and like the variety in their work. As a "Jack-of-all-trades" a man earns higher wages than would be paid to the ordinary six-day-per-week railway repair man.

Considerable rail bonding has been done recently by the company. Although the original line was adequately bonded throughout, many bonds were stolen during the four years when the road was not in operation. It has been necessary, therefore, to devote special attention to installing bonds. This is done by electric arc welding.

Some work has had to be done also on the replacement of wood poles. Approximately 15 new poles have been installed during the past eighteen months. For this purpose untreated chestnut poles are used and have been found to be entirely satisfactory.

On account of having considerable trackage in paved streets in addition to the open track on private right-of-way the company has both a line wagon and a line car. The former is a one-ton Ford truck, on the back of which have been mounted two extension ladders, joined together at their upper ends and hinged to the floor. Removable ¾-in. bolts are used as hinge pins. This arrangement makes it possible to take the ladders off the truck without difficulty.

For work on private right-of-way a Fairmont gasoline-propelled rail car and trailer are used. The same ladders which are mounted on the Ford truck can be mounted on the trailer by attaching them to a duplicate set of hinges. This light vehicle can negotiate the rather steep hills at a good speed and has proved of great value. Gasoline propulsion is an advantage when hunting trouble with the trolley dead. The trailer is so light that it can be easily lifted off the rails to allow a regular car to pass and can then be replaced by the two men in the line maintenance crew.

Advisory Council for Accident Prevention

ACCIDENT prevention work on the Chicago Surface Lines, described in the ELECTRIC RAILWAY JOURNAL for Feb. 21, page 313, has been carried on through a general advisory council headed by V. T. Noonan, supervisor of accident prevention. Other members of the council are as follows; H. H. Adams, superintendent of shops and equipment; C. H. Evenson, superintendent of transportation; H. B. Fleming, chief engineer; F. M. Hamilton, supervisor of purchases and stores; A. J. Klatte, assistant electrical engineer; F. L. Kriete, general attorney, and E. L. Kuntzner, secretary.

Interurban Railway Puts Way Maintenance on a Competitive Basis

Inspection of Track and Roadway Made on the T. H., I. & E. Lines as a Basis of Awarding Prizes for Careful Maintenance Also Furnishes Useful Information for Budget Making

By D. H. Walker
Assistant Engineer Terre Haute, Indianapolis & Eastern Traction Company

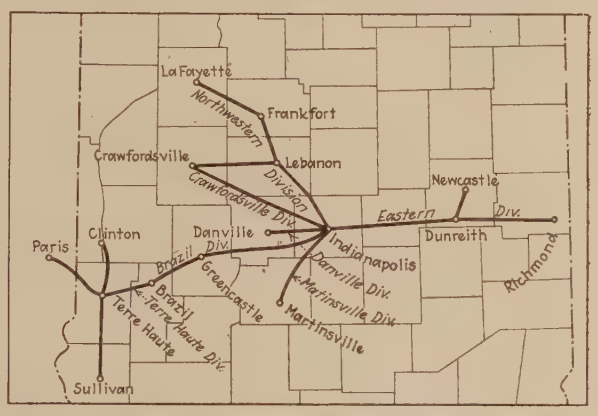
AN INSPECTION of track and roadway for the purpose of awarding prizes to the various divisions and sections having the best track after completion of the year's work was made by the Terre Haute, Indianapolis & Eastern Traction Company in December, 1924. In the spring the chief engineer had told the division supervisors that prizes would be awarded by the company to those having the best sections at the end of the year. The matter was then forgotten for a while but later the question arose as to the basis on which the prizes should be awarded. It was decided to make an inspection trip over all divisions and to give the prizes to those sections and divisions which had achieved the best results as shown by this inspection.

In addition to being a basis for awarding prizes the trip was expected to accomplish other results. Expenditures on the track for the past year had been made in accordance with a budget prepared at the beginning of the year. A new budget for 1925 was at that time in course of preparation and it was felt that an inspection of the entire system would help to give a clear impression of what had been accomplished and would show which sections would require the greatest expenditures for the coming year.

Moreover, it was thought that each supervisor would benefit by an inspection of the entire system. Supervisors of the various divisions had been busy with their own work and had had no opportunity to inspect the work of the other divisions. Meetings had been held twice each month with the roadmaster and the work outlined to all alike. Visible evidence of how the other man had carried out these instructions was deemed advisable. That this inspection would help to stimulate competition by showing the man with poor track that he had much to do to bring his work up to the standard was another point in favor of the plan. Such an inspection would also instill pride in the man with good track and encourage him to maintain his high standards.

As every man takes more interest in his own work when he finds that others are interested in it too, it was thought that the morale of the track department would be improved by including the general superintendent and other officials of the company among those making the trip. The superintendent of distribution found that the inspection would afford him a good opportunity of making a careful study of the overhead lines and he, therefore, joined the party. Besides those already mentioned the inspection party included the purchasing agent, the chief engineer, four superintendents of divisions, four supervisors of roadway, the roadmaster and assistant roadmaster, two assistant engineers, and the foreman of bridges and buildings. For part of the trip the chief dispatcher and master mechanic accompanied the others.

Three days were occupied by the inspection. A special car was used and each run was made either as the second section of a limited train or as an extra. The car used was well suited for inspection purposes, being of the observation type as shown in the accompanying illustration, with ample room at the front end for those making the inspection to get a good view of the track.



The Terre Haute, Indianapolis & Eastern Traction System Is Operated in Seven Divisions

The lines of the Terre Haute, Indianapolis & Eastern Traction Company radiate from Indianapolis as a center, as shown on the accompanying map. The Brazil and Danville lines constitute a division under one supervisor. The Crawfordsville and Martinsville lines make up another division. The Northwestern division includes the lines from Indianapolis to Lafayette and from Lebanon to Crawfordsville. The Eastern division embraces the track from Indianapolis to Richmond and the branch from Dunreith to Newcastle. By considering these four groupings the number of sections were about equal in all divisions. It was necessary to "back track" somewhat in making the inspection, but this offered the inspectors an additional chance to recheck any features in doubt on the first examination. Approximately one day was given to each division.

For the purpose of rating the sections, grades were marked by the inspectors on four groups of subjects. Each group was assigned a specified number of points under the three markings of Good, Indifferent, and Poor. The card shown on the following page is a sample of those prepared by the inspectors on each division.

Terre Haute, Indianapolis and Eastern Traction Company

REPORT OF CONDITION OF TRACK

Eastern DIVISION

B. Adkins SUPERVISOR Dec. 1924 192

SECTION NO.	FOREMAN	MARK THUS	GROUP NO. 1 Fence and Drainage	GROUP NO. 2 Surface, Ballast, Line and Joints	GROUP NO. 3 Siding, Switch Stand and Lamps	GROUP NO. 4 Farm and Road Crossing, Right of Way, Station Grounds	TOTAL
		GOOD	42	18	16	8	84
		INDIFFERENT	34	16	12	6	68
		POOR	18	12	4	2	36
1	Earl Bell						
2	O. Mattix						
3	W. Wyremon						
	TOTAL						
	AVERAGE						

Form Used by Inspectors in Grading the Various Track Sections

Fences and drainage were the principal items in the first group. Special attention was paid to alignment and condition of posts and gates, cleanliness of side ditches, freedom of culverts from obstruction, and condition of the embankment. Surface, line, ballast and joints were included in the second group. Inspectors were asked to note the alignment of track, both tangent and curve, riding quality at entrance to curves, ballast line at shoulder just outside edge of the tie and at the toe of the slope, condition of weeds, and the riding quality of joints.

The third group included sidings, switch stands and lamps. Attention was paid to cleanliness of side tracks, fit of switches, whether switches were properly oiled and had head rods in the correct position, whether switch lamps were plumb, clean and burning and whether the light was in focus with the bull's eye. Farm and road crossings, right-of-way, and station grounds constituted the fourth group. Attention was paid to whether planks were properly renewed and box crossings filled, whether the surface of the roadway at crossings was properly filled around the track joints, whether the shoulder of the bank was weed grown, and the general cleanliness of the ground around stations and shelter houses.

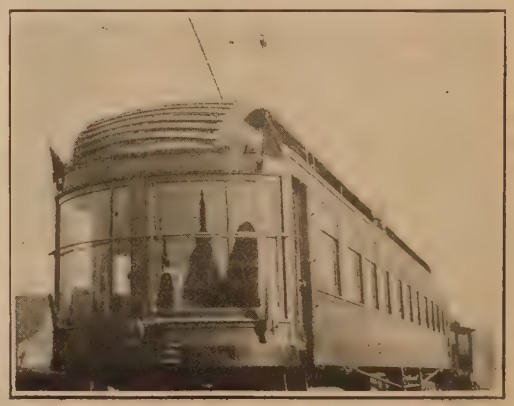
Since so many points were considered in each group, the grading was done by two men. The purchasing agent, the superintendent of distribution, a division superintendent and an assistant engineer took the four groups with one of the supervisors assisting each man. The foreman of bridges and buildings acted as alternate and substituted on each division for the supervisor whose territory was being covered.

In the final grading of divisions and sections consideration was given by the office, after all inspectors' reports were in, to the amount of money spent on each division during the year. The committee markings were averaged for all groups. Then track expenditures per mile for labor and material were figured for each division and the average for all divisions. The percentage of each division, as compared to the average, was used in revising the markings as follows:

	Per Cent of Average Expenditure	Committee Markings	Revised Markings
Eastern and Newcastle Branch	198.2	76.43	38.56
Northwestern and Crawfordsville Branch	72.3	73.50	101.66
Crawfordsville and Martinsville	48.6	73.81	151.81-1st
Brazil and Danville	62.3	75.36	119.82-2nd

Prizes of $25 and $15 were awarded on this revised basis to the two supervisors. Section prizes of $15, $10 and $5 were awarded to each division in accordance with the committee markings. Vouchers with the following inscription: "First (etc.) prize for meritorious work on your section during the summer of 1924," were sent to the winners the day before Christmas.

Some changes in the method of marking have been decided upon for the next inspection. Henceforth, four classifications will be used, Good, Fair, Indifferent and Poor. Values given the group markings will also be changed somewhat. It was found that with the values used the difference between good track and bad track could be more than counterbalanced by fences and drainage. The ideal way, the railway believes, would be to have as inspectors men not connected with the company but who are familiar with track and roadway work. Then grading could be on an absolutely fair basis with no prejudice because of any knowledge of actual conditions and reasons why one division should be better than another. Such results could then be revised more fairly in accordance with expenditures.



At Left, the Rear End of the Inspection Car Is Arranged for Observation. At Right, a Good View of the Track Ahead Can Be Obtained Through the Windows at the Front of the Car

Double-Head Welder Cuts Wheel Maintenance in Detroit

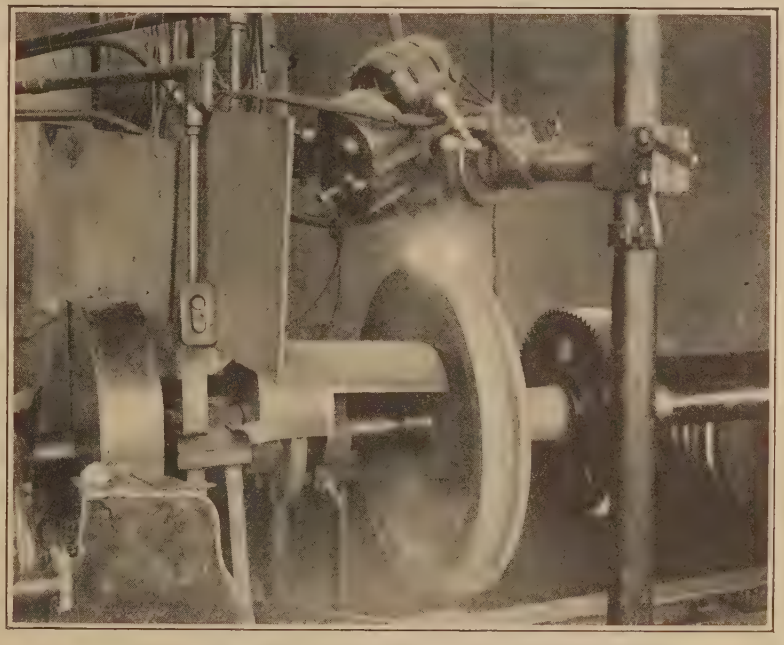
By A. C. Colby
Superintendent of Equipment, Department of Street Railways, Detroit

Time of Welding Wheels Reduced Almost Half by Addition of Second Head on Automatic Welder — Special Grinder Increases Mileage by Reducing Amount of Metal Removed

ROLLED steel wheels used by the Department of Street Railways in Detroit are welded and ground when the flanges become worn, with a view toward obtaining maximum wearing life. This is accomplished by reducing to a minimum the amount of metal that must be removed from the treads of the wheels to true up their contours after they have become worn in service.

The practice of welding flanges, either with automatic or hand equipment, has been adopted by many properties. Results with automatic equipment have been reported uniformly satisfactory, but some difficulty has been experienced with hand welding. When only a comparatively small number of wheels are to be welded, however, some properties are using the hand method with apparent success.

One feature of the Detroit practice is the use of a double-head welding machine to speed up the rate of welding. This lays two beads of metal on the wheel flange simultaneously instead of one bead per revolution, as in the case of a single-head machine. It was found to be a comparatively simple matter to add the second welding head to a single-head machine, thereby almost doubling its capacity. The cost of welding any particular wheel depends of course on its condition, but for a given wheel, the double-head machine reduces by almost half the time formerly taken with the single welding head.



A Second Head Has Been Added to the Automatic Welder
Two beads of metal are deposited simultaneously and the total time required is reduced almost half. Note the guard to protect the journal from particles of metal.

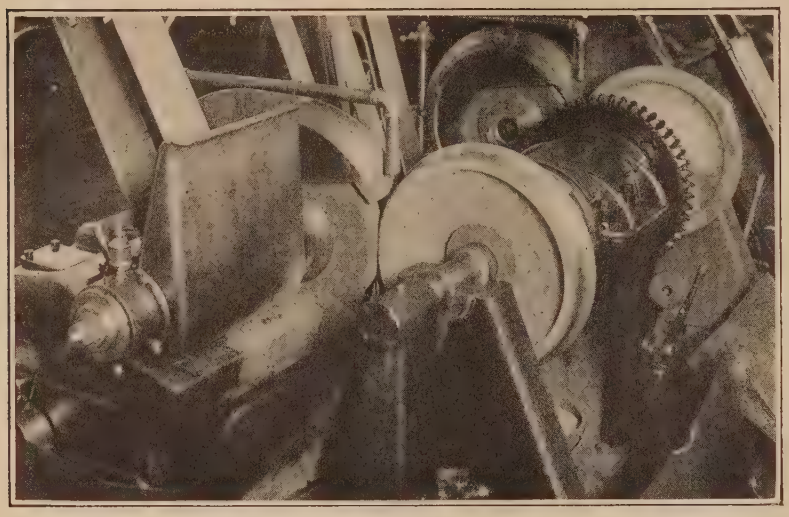
Welded Wheels Are Trued by Grinding

After welding, the contour of the wheel is trued up by grinding the tread and flange instead of turning. This results in the removal of a minimum amount of material from the wheel. Consequently, a considerable saving in the amount of metal removed from the wheel is made as compared with the customary practice of turning the wheels either with or without flange welding. To make grinding a success, however, the wheels must be attended to before they become worn beyond a certain stage. If one of the flanges is permitted to wear excessively thick, grinding is no longer satisfactory or economical, and it is better to turn the wheels to restore their contour.

The A. E. R. E. A. standard limit-of-wear gage is used by the Department of Street Railways for determining when wheels should be taken out for attention. If they are removed promptly after reaching the limit shown by this gage, the flange and tread are usually found to be in condition which permits them to be repaired by welding and grinding.

An accompanying illustration shows the welding machine in operation. This is the standard type of General Electric Company automatic equipment, and the arrangement of the two welding heads is clearly shown. No difficulty has been experienced in feeding the welding rod from each head so that the material is deposited uniformly on the wheel.

The grinding machine is shown in a second illustration. This was built by the Norton Company, Worcester, Mass. The grinding wheels are shaped so as to finish the flange and tread simultaneously. The accompanying sketch shows the shape of the grinding wheel. When these wheels become worn, they are returned to the manufacturer for redressing. After the throat and flange are finished, there is a sharp corner left at the back of the flange which must be ground off. Some



This Grinder Was Built Specially for Truing Up Wheels After Welding

saving in time has been made by cutting this corner off with an acetylene torch, and then finishing with the grinder.

Subsequent to the installation of the grinder by the Department of Street Railways, a similar machine was installed in the River Rouge plant of the Ford Motor Company and is used for grinding locomotive wheel tires.

Costs of Welding and Grinding

Comparative figures compiled for the month of October, 1924, show the costs of welding and grinding wheels. During that month a total of 485 labor hours were required for welding 250 wheels, of which approximately half had a nominal diameter of 34 in., and the other half 26 in. On both welding and grinding work, one man handles the machine. The rate of pay is 80 cents per hour. In the case of welding, the average time per pair of wheels was 1.94 hours, which makes the labor cost without overhead $1.55. This is an average figure for both the 34-in. and 26-in. diameter wheels.

There were 200 pairs of wheels ground during this month in 246 labor hours, or at the rate of 1.23 hours per pair of wheels. The labor cost for grinding was consequently 98 cents per pair. In addition to labor, there must be added the cost of welding material and power. These costs have been established as follows:

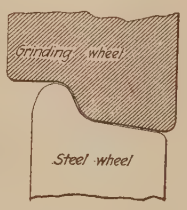
Cost of Welding Wire	
34-in. wheel	$0.51
26-in. wheel	.39
Average	$0.45
Cost of Electric Energy	
34-in. wheel, 23.1 kw.-hr. at 2.7 cents	$0.62
26-in. wheel, 16.5 kw.-hr. at 2.7 cents	.45
Average	$0.54

The total average costs without overhead are therefore as follows:

Welding labor	$1.55
Grinding labor	.98
Welding wire	.45
Energy	.54
Total	$3.52

This shows little saving, if any, over the cost of turning, using a modern type of lathe, with proper handling facilities and only one man. But it is in the increased life of the wheel that the greatest advantage comes from welding and grinding. The practice followed in Detroit has not been in effect long enough to permit the accumulation of comparative mileage figures, but an estimate can be made of the results to be expected. In addition, while the time of the welding operator is charged entirely against the wheel work in the figures above, he is available for miscellaneous welding jobs during the period that the automatic machine is in operation.

The standard flange in Detroit is 1 in. thick and $\frac{3}{4}$ in. high. On the basis of the A. E. R. E. A. standard limit-of-wear gage for this flange, it is necessary to remove approximately $\frac{7}{16}$ in. thickness of metal from the tread to restore the flange to its normal contour by turning, after it has reached the point indicated by the gage. Assuming that this occurs twice during the life of the wheel before it is scrapped, the wheels would have three periods of wear from the time they are first put into service until completely worn out. Starting with a tread thickness of $2\frac{1}{2}$ in. when new, and assuming that the wheels would be scrapped when the thickness is reduced to $\frac{1}{2}$ in., this would leave about 2 in. of effective metal in the tread. But of this amount, two turnings, each $\frac{7}{16}$ in. thick, are removed during the life of the wheel, to true up the contour of the tread and flange. Consequently, a total of $\frac{7}{8}$ in. of this metal finds its way into the shop scrap pile, and only about $1\frac{1}{8}$ in. of metal is actually worn off in service.



The Grinding Wheel Is Shaped so as to Finish Both Tread and Flange at Once

Assuming an average wheel life of 100,000 miles, this is obtained from the $1\frac{1}{8}$ in. of metal left to be actually worn off in service. This gives a mileage of slightly more than 11,000 for each $\frac{1}{8}$ in. of wear. If flanges are welded and ground, very little metal is taken off the tread to true up the wheel. Consequently a large part of the $\frac{7}{8}$ in. of metal which was formerly turned off is available for actual wear in service, and the wheel mileage may be reasonably expected to be increased in the same proportions as for the average mileage obtained. With 11,000 miles obtained for each $\frac{1}{8}$ in. of wear this would increase the mileage by 77,000 and would therefore add more than 75 per cent to the wheel life.

Mileage Is Increased

In addition to the saving made in the amount of metal taken off to true up the wheel, the practice of welding and grinding increases the mileage in another way. It is well known that when a wheel is turned the cut must be taken deep enough to remove the hard surface which has been rolled on the tread by contact with the rail. The practice of welding and grinding does not require the removal of this hard material and the life of the wheel is therefore increased beyond the amount that is indicated by the actual thickness of metal saved.

In the Suburbs a Portion of the Track Is in a Reserved Strip in the Center of the Street

Special Organization Handles Track Maintenance Work

United Railways & Electric Company of Baltimore Has Separate Forces for Maintaining and Rebuilding Track — Efficiency Is Promoted by Keeping Men Continuously Employed on Same Kind of Work—Maintenance Is Done on a Monthly Budget Plan

TO IMPROVE the efficiency of the men engaged in maintaining its track, the United Railways & Electric Company of Baltimore has developed separate organizations for doing this work and for rebuilding track. Replacements that are charged to capital or depreciation accounts are done by the reconstruction forces under the direction of the principal assistant engineer. All other track repairs are done by the maintenance of way forces under the roadmaster. Supervision over both organizations is exercised by the chief engineer. This arrangement is not inflexible, however. Men from the maintenance forces are engaged in reconstruction work from time to time and vice versa, but under normal conditions the two organizations function separately.

For maintenance of way purposes the system has been divided into four districts. The city of Baltimore is approximately square, and there is roughly the same amount of trackage in each of the four quarters. The east and west dividing line follows the general direction of Centre Street, while Charles Street is the north and south line separating the maintenance of way districts. Each district is further subdivided into a division and a section. The division comprises all the paved track in the district, while the seltion takes in all the open track. How nearly equal in mileage the various divisions and sections are is shown in the following table:

MILEAGE OF DIVISIONS AND SECTIONS

District	Paved Track	Open Track	Total
1. Northwest	56.07	46.59	102.66
2. Northeast	58.47	44.37	102.84
3. Southeast	50.75	45.20	95.95
4. Southwest	77.43	36.94	114.37
Total	242.72	173.10	415.82

A division foreman is in charge of all the work done on track in paved street in each district, and a section foreman looks after the open track. These eight foremen report to the roadmaster. As the work done in paved streets is more extensive and more complicated than that done on private right-of-way the position of division foreman is considered the more responsible and is ordinarily held by an older and more experienced man. Under the division and section foremen are gang foremen to direct the individual jobs.

The total maintenance-of-way force varies from about 300 to 400 men. Of these 30 are bridge carpenters, 30 are curve greasers, and 20 are track shopmen. There are also a few men engaged in miscellaneous occupations such as inspecting electric switches, renewing hard centers, etc. Trackwork usually can be done during 10 months of the year, but during the other 2 months the men are kept busy on emergency rail replacements, joint repairs, or snow fighting.

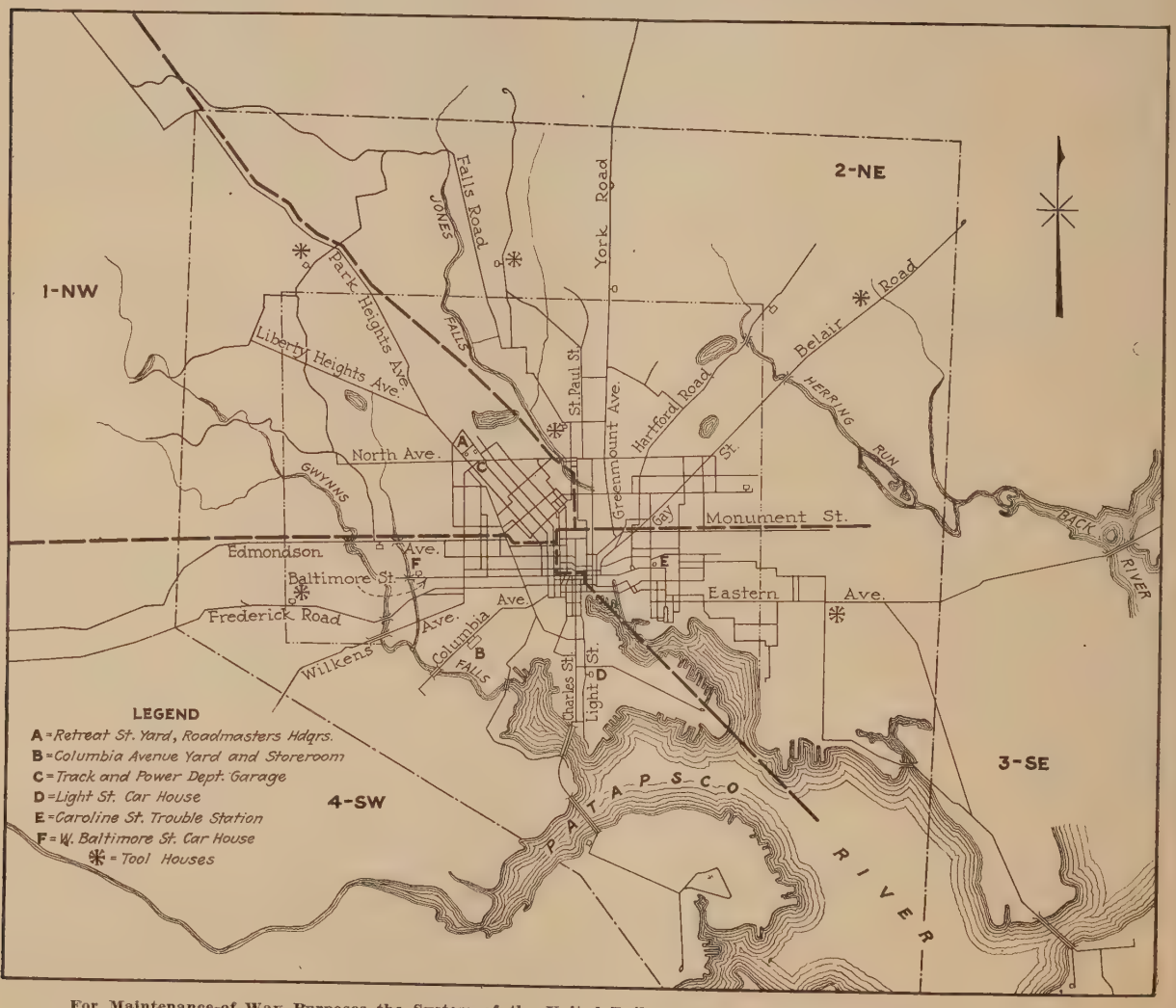
Maintenance work is done on a monthly budget basis, and the number of men varies somewhat according to the allowable expenditure for the month. In summer, or when particularly large undertakings require it, the force is increased. The men are hired by the gang foremen subject to the approval of the roadmaster. They must also pass examination by the company's doctor before they are allowed to go to work.

For track in paved streets the railway is now using A.E.R.E.A. standard 7-in. grooved girder rail, on wood ties, spaced on about 2-ft. centers. Six inches of stone ballast is machine tamped under the ties. Joints are installed by the electric seam-weld process. Where the remainder of the street is paved with asphalt, which is widely used in Baltimore, two rows of granite block liners are placed on each side of the rail. When granite block paving is used over the entire street the railway omits the liners alongside the rail.

Some track has been built using T-rail and nose block, but this is not thought to be very satisfactory.

No economy has been effected by using such a method because the saving in the cost of rail is counterbalanced by the greater expense of the blocks.

Joints on all tracks in paved streets, with the exception of those in special work, are welded. The company has been using welded joints for many years, beginning with cast welds, later using electric bar welds, riveted joints with thermit welded bases and finally electric seam welds. Little trouble has been experienced with cupped joints except in track that is very old. When cups first appear they are ground out.



For Maintenance-of-Way Purposes the System of the United Railways & Electric Company of Baltimore Is Divided Into Four Districts with Approximately the Same Track Mileage in Each

As the age of the track increases and the cups become deeper they are built up with an electric arc welder and then ground smooth. Comparatively few joints, however, need to be treated in this manner because, as a general rule, by the time such a condition develops the track is practically worn out and ready for reconstruction.

Where track has worn until there remains only about 2 or 3 years of useful life, the rail begins to fail by breaking. This may be either at or near the joint or frequently remote from it. In such a case the defective part is cut out and a worn piece of rail of the same section installed. Ordinarily this piece of rail is at least 12 ft. long as it is felt that rails of shorter length are apt to work loose. In making repairs of this character bolted joints are generally used because the expense of welding would not be justified for the short time that the track is to remain. Moreover, where rail is worn to such an extent it is difficult to make a satisfactory job of welding. Having granite block liners along the rail makes it possible to cut out defective pieces of rail and install new pieces without disturbing the asphalt.

A careful record is kept of the exact time when paving is opened up and when it is closed again. It has been found that damaged claims for injuries incurred by people falling into the excavation have sometimes been presented long after a job was completed, so that these records have been helpful in furnishing details concerning the work in such cases. When the paving is opened up at night kerosene torches are placed down in the hole along the rail. These burn all night and illuminate the track area without interfering in any way with the passage of cars.

In the outlying sections of the city some of the track is in a reserved strip in the center of the street. At the time the railway lines in the suburbs were first built they were located alongside unpaved roads. When the city grew and these streets were improved it was

desired to have the tracks in the center. The company agreed to this change in location, provided that a strip was reserved for its use.

The width of the reserved strip varies somewhat with the width of the street, the minimum being 23 ft. and the maximum 26 ft. Wood ties and 85-lb. standard T-rail with bolted joints is the standard type of construction used. Its appearance is shown in an accompanying illustration. The overhead construction is carried on concrete poles, and concrete curbs separate the reserved strip from the vehicular roadways. No grass is planted in the reservation. In some locations hedges have been planted along the outer edges, but this practice is not favored by the railway. Experience has shown that there is a greater tendency for litter to accumulate in track planted in that way, and the appearance is marred rather then enhanced by the hedges. Maintenance work on track in the reserved strip is under direction of the section foremen.

Welded track, of course, needs no bonding, but through special work and the open T-rail track, copper bonds are used. They are welded in place by the acetylene torch method. In addition to bonding the joints through special work heavy copper cables are used for bonding around the entire job so that the return circuit is not dependent upon the special work.

Transportation of materials for the maintenance of way department is furnished by 11 White trucks and such work cars as may be needed. Each division has a 2-ton truck and each section a ¾-ton truck. In addition to these there is a 2-ton truck to carry the equipment used in renewing frog inserts, and another for repair work on drains and culverts. A ¾-ton truck is employed during the day to take care of electric switches. At 5:30 p.m. this truck reports to the roadmaster's office, and is kept there during the night to answer emergency calls.

All trucks are equipped with service recorders. Charts from these instruments are filed in the office of the roadmaster and from them it is possible to determine whether the trucks are being used to best advantage, that is, how much of the time they are in motion and how much time is spent waiting. The railway believes that these devices have saved their cost several times over.

Two Rows of Granite Block Liners Along Each Rail Facilitate the Making of Minor Repairs

Each division and section has two sets of edge tools. One set is kept in a conveniently located tool house, and the other set, newly sharpened, is kept at the general track maintenance headquarters. Small tool houses, 10 ft. x 15 ft., have been built of corrugated iron and placed at spots readily accessible for the work on the outlying lines. Tools are transported back and forth between these locations and the yard by motor truck to reduce to a minimum the carrying of tools on passenger cars. For work in the center of the city the tools are carried and kept in the 2-ton divisional trucks.

Material for track maintenance work is transported by these motor trucks when the quantity required is small. Large lots and heavy materials are carried on work cars. These are under the direction of the superintendent of work cars, who has his office at the general storage yard. Crews to operate work cars and men to handle heavy material at the storage yard are under the jurisdiction of the track department, even though the material itself is controlled by the storekeeper until requisitioned. Comfortable quarters and recreational facilities have been provided for the yard men.

Although their territory spreads over more than 400 miles of track the division and section foremen keep in close touch with maintenance headquarters. Wherever he may be, each man telephones in to the roadmaster's office at 9 a.m., 11 a.m., 1 p.m. and 3 p.m. At 4 o'clock these eight foremen, together with the

Good Housekeeping Is Emphasized at the Main Columbia Avenue Storage Yard

roadmaster and assistant roadmaster, sit down in the office and discuss the problems of the day. The quantity of material that will be needed the following day on each division and section is reported by the foreman in charge. Arrangements are then made for securing it from the storekeeper and transporting it to the desired location.

At this time the roadmaster calls attention to any reports that have been received concerning defective track or paving. All employees are encouraged to make report of anything of that kind that they find. Very often the maintenance department is already aware of the defect, but the co-operation of the trainmen has been found helpful in many cases. A special effort is made to repair as quickly as possible any defect reported in this way.

A serious maintenance-of-way problem is presented by the large amount of special trackwork in Baltimore. The United Railways & Electric Company has 826 such layouts, many of them being subjected to heavy traffic. The accompanying map shows the many track intersections in the center of the city. Moreover, modern

Tool Houses of This Type Have Been Erected in Convenient Locations to Save Carrying Maintenance Tools Long Distances

rolling stock will not clear on some of the old curves and the railway is installing clearance curves as fast as it is practicable to do so.

One gang which reports directly to the roadmaster is known as the "hard center" gang. It is engaged in tightening up, resetting and renewing frog inserts. A truck has been provided, as mentioned in a foregoing paragraph, to haul tools and materials for this work. Worn special work is built up by welding with an Indianapolis welder and grinder.

It has been found that where steel wheels are operated over manganese switch tongues there is a tendency for the sharp edges of the tongue to bite into the comparatively soft steel of the wheels, thus causing them to climb. The company's specifications require that the edges of new tongues shall be rounded off, but the tendency is for them to wear sharp again. A special gang of two or three men is employed to keep switches in good order and as the tongues develop sharp edges they are rounded off by grinding or hammering.

At the track yard the company has its own special-work manufacturing plant. This is a well-equipped shop capable of turning out any work that may be needed. Advantages claimed for this practice are that the work can be done at somewhat less cost than to buy it outside, and that it can be done much quicker. This reduces the number of parts that it is necessary to carry in stock. Hard center frogs can be made in 48 hours and built-up frogs in 10 hours, if necessary.

Overhead Railway with Chain Hoists Serves the Special Work Shop and Yard

This plant supplies only a part of the railway's special work requirements. It is operated continuously throughout the year with a force of from 15 to 20 men. When the demand exceeds the capacity of the plant special work is purchased outside. No attempt is made to increase the output by employing additional men.

Compromise and ordinary joint plates are made at this shop. Rails are cut to whatever length needed for a particular job, and any necessary bolt holes are drilled. Maintenance tools are resharpened.

The machinery used for this work includes one each of the following:

- Hilles & Jones No. 4 rail bender capable of handling any sized rail.
- Hilles & Jones No. 3 punch and shears, which will punch a 2-in. hole in 1¼-in. steel.
- Highley cold-cut saw No. 20.
- Highley circular saw sharpener.
- Barnes upright drill No. 3 of 2½-in. capacity.
- Detrick & Harvey open-side frog and switch planer, which makes a 15-ft. cut.
- Detrick & Harvey bolt cutter.
- Norton No. 7 emery grinder.
- Pennsylvania air compressor.
- Three Springfield swing grinders.
- Pneumatic hammers for chipping off the rough edges of castings.

In winter the maintenance-of-way forces are thoroughly organized for snow fighting. The division and section foremen and their men report at

An Upright Crane with a Chain Hoist at the End of a Horizontal Arm Is Used for Loading Materials in the Special Work Yard

what are called "storm quarters," in most cases operating carhouses. These locations are shown on the accompanying map. The curve greasers are put to work cleaning switches in the center of the city when the snow reaches a depth of 1 in. The rest of the switches are handled by division and section foremen with 67 of their men. When snow reaches a depth of 3 in. the supervisor of reconstruction reports to the roadmaster's office with his own force of approximately 100 men. With this organization to back up the transportation department, the lines have all been kept open except under extremely bad storm conditions.

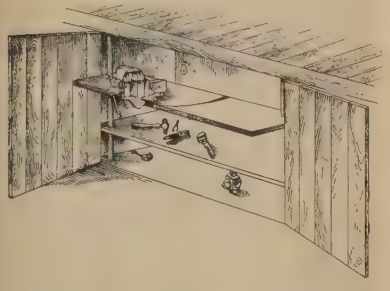
Special efforts are made by the maintenance department in summer to improve the appearance of the grounds surrounding carhouses and terminals. Much work has been done in planting grass and bushes in such locations and the appearance has been greatly improved.

Pit Tool Boxes Reduce Time of Bus Repairs

Cabinets in Sides of Pit Developed by Des Moines City Railway Contain Tools, Spare Parts and Supplies Required for Bus Maintenance

TO REDUCE lost time and save many extra steps taken between the pit and work bench in the routine maintenance of bus equipment, the Des Moines City Railway constructed the completely equipped inspection and maintenance pit shown in the accompanying illustration. This pit is provided with storage cabinets for tools, supplies and spare parts, a folding work bench and vise, and other facilities for doing work under the bus chassis.

A location was selected at one side of the car repair shop, where a convenient driveway is available for moving buses in and out of the shop. Practically all bus inspection and repair work is done here. This includes inspection and care of batteries and tires, changing of lubricating oil, etc.



By Means of a Folding Bench Equipped with a 4-In. Machinist's Vise Minor Repairs Can Be Made Without Leaving the Pit

In the Des Moines City Railway Shops the Repair and Inspection Pit Is Completely Equipped with Tools, Spare Parts and Supplies

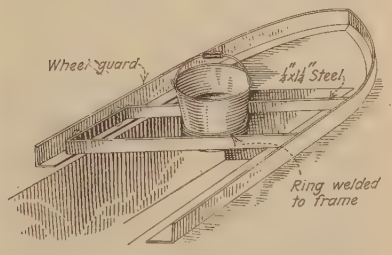
The length of the pit is 24 ft. 6 in. at the bottom, and 29 ft. at the top. It is 3 ft. 2 in. wide. At one end the depth is 4 ft. 6 in. and at the other end is 4 ft. 4 in., thus providing for drainage. Five storage cabinets 4 ft. wide and 2 ft. deep are formed in the concrete walls on each side of the pit. They are closed by swinging steel doors.

To form a guide for the bus wheels a 6-in. x 4-in. angle extends around the front and sides of the pit. The horizontal leg of this angle is turned toward the pit. This not only serves for fastening the frame in place, but also forms a secure reinforcement near the edge of the floor to support a jack at any point around a bus. The horizontal leg on the pit guard also serves as a track for the bucket carrier shown in another illustration.

Included among the tools and supplies stored in the cabinets are hand tools, special tools and extra parts that are most frequently needed. In one cabinet, a folding bench is arranged so that it can be swung out into a convenient position when needed and can be folded back out of the way when not in use. This bench carries a 4-in. machinist's vise which is suitable for supporting parts while adjustments or minor repairs are being made.

Tire chains, distilled water and battery acid, a large grease gun, a supply of transmission and engine oil and a vulcanizing outfit for making tire repairs are all conveniently stored in the pit. A CP-27 car compressor supplies air at 125 lb. pressure. The air hose is long enough to reach to the extreme end of the pit. Spare tires and tubes, extra battery parts and a battery tester are also included in the pit equipment. Battery charging wires are arranged so that when a bus is going to be out of service for some time, they can be connected to the bus battery without removing this from the vehicle. At one end of the pit an ordinary 12-in. electric fan is mounted so that this "pit workshop" can be kept free of fumes and provided with circulating air in warm weather.

A bucket carrier previously mentioned has proved to be an additional convenience. Ordinarily, when a bus is standing over a pit it is convenient for a workman to get at the drain plug for changing either transmission, differential or crankcase oil, but it is difficult to provide a suitable support for a pail which will not be in the way of a workman moving about the pit. The pail carrier consists of a light rectangular frame made of ¼-in. x 1¼-in. steel with a ring of the same material welded in the center. The frame is mounted on four rollers inside the wheel guard at the sides of the pit, thus permitting the carrier to be moved easily to any desired location under the bus. With the bucket supported as shown, the pit can be kept clean, and there is no obstacle to interfere with the workman when he is doing other tasks while waiting for the oil to drain out.



A Bucket Can Be Supported Close Under the Engine or Transmission When Draining Oil by This Apparatus

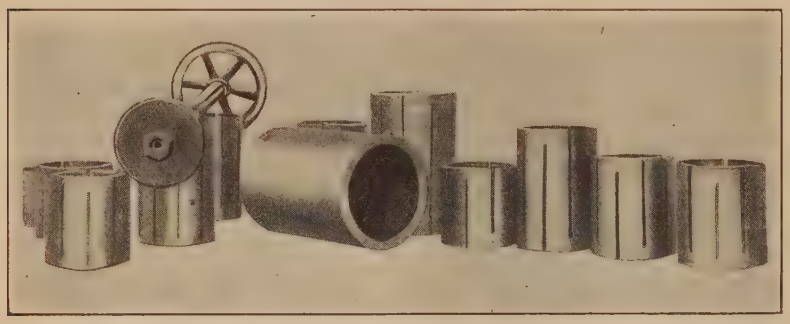
This convenient pit and its equipment were developed by A. J. Clements, mechanic in charge of bus maintenance, under the direction of C. R. McMahon, master mechanic.

Equipment Maintenance Notes

Self-Centering Chuck for Armature Bearings

By T. E. Wood
Master Mechanic Omaha & Council Bluffs Street Railway

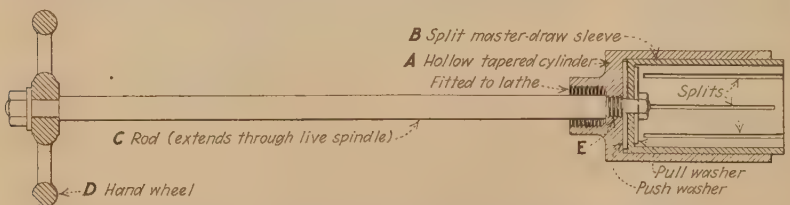
A SELF-CENTERING chuck for holding armature bearings while they are being machined has been designed and built in the shops of the Omaha & Council Bluffs Street Railway, Omaha, Neb. The object was to develop a method of holding the bearings securely in place in the lathe, while at the same time making it possible to center them accurately and quickly, so as to reduce the cost of doing this work.



Parts of Self-Centering Armature Chuck of Omaha & Council Bluffs Street Railway. The Split Sleeves Shown Accommodate Bearings of Various Outside Diameters

The principal parts of the chuck consist of a hollow tapered cylinder which is threaded on the lathe live spindle like an ordinary chuck, a split master draw sleeve, a rod extending through the lathe live spindle, and a set of split sleeves to accommodate different sizes of bearings.

In the accompanying illustration are shown the various parts disassembled. The drawing shows a section through the complete assembly. The hollow tapered cylinder *A* forming the body of the chuck holds the split master draw sleeve *B*, which is pulled tight by the hand wheel *D* acting through the rod *C*, the other end of which is threaded into the closed end of the cylinder at *E*. This compresses the sleeve as it is drawn into the taper. Each draw sleeve has ten longitudinal $\frac{1}{8}$-in. slots equally spaced, and running alternately to within $\frac{1}{2}$ in. of alternate ends. The sleeves range in thickness from $\frac{1}{8}$ in. for the one to take the largest bearing to $\frac{3}{4}$ in. for the smallest. The correct size of sleeve is inserted in the tapered cylinder to accommodate the diameter of bearing being machined. Both the cylinder and the sleeves are of cast iron.



A Longitudinal Section Through the Assembled Chuck. The Bore of the Outside Cylinder Is Tapered so that the Split Sleeve Is Compressed as It Is Drawn Up into the Cylinders. The Rod C Extends Through the Lathe Live Spindle

Jigs and Dies Stored Systematically

ALL jigs, dies and fixtures used in the railway shop at Columbus are stored on shelving in the toolroom adjacent to the machine shop. The various pieces of equipment are roughly classified as to the machine upon which they are to be used, and are indexed by numbers on the framework of the shelving. Each piece is stamped with the name, number and type of blank with which it is to be used. This simplifies the task of finding a particular fixture, and makes it possible to send a machinist's helper to the toolroom.

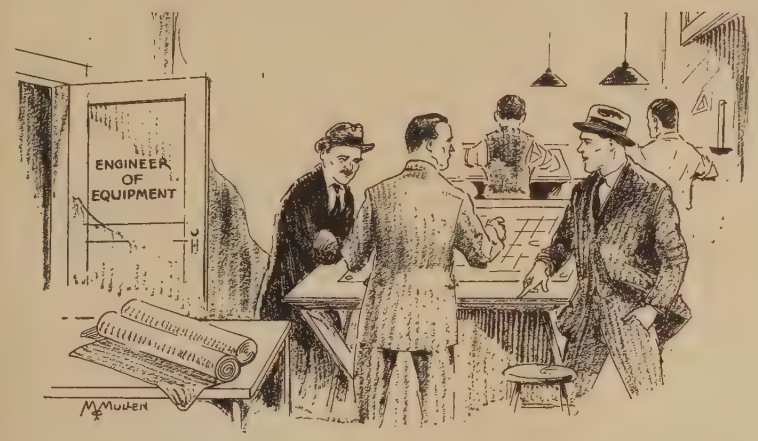
Dumbwaiter Saves Time of Shopmen

THE storeroom for small maintenance parts used by the Eighth Avenue Railroad, New York City, at its 155th Street shop is on the second floor of the shop building. Ordinarily this is served by two stairways. Trouble caused the shopmen, and the resultant loss of time, from climbing the stairs has been overcome by C. P. Westlake, supervisor of equipment, through the installation of a dumbwaiter. The men obtain requisitions from the foremen of the different departments. These are delivered to the storeroom in the dumbwaiter. The storekeeper then fills the order quickly and lowers the dumbwaiter with the parts required. Movable shelves are provided to accommodate different sizes and varieties of material.

A Dumbwaiter Is Used by the Eighth Avenue Railroad for Quick Communication Between Storeroom and Maintenance Shop

Dick Visits a Large Property

And Finds One of His Ideas in Practice



DICK PRESCOTT, engineer, and Steve White, carpenter foreman of the Consolidated Railway & Light Company, after completing their inspection at Centerville, arrived in Rushburg the following morning. As this was the largest city to be visited on their trip Dick felt that here, if anywhere, they would find concrete suggestions regarding the organization of an equipment engineering department.

Much to their delight, the engineer of equipment accompanied them on their trip through the shop. They lost no time in getting started.

As they entered the drafting room Dick brought up a subject in which he was particularly interested.

"What are you doing to standardize the various parts and fittings used on your different series of cars?"

"That's a very live topic with us," was the reply, "We started in about 2 years ago to see what we could do along that line and after we really understood what we were driving at, began to make pretty good headway."

"How do you go at it?" asked Dick.

"Come over here and I can give you quickly a rough idea of our method."

They moved over to a near-by table. He picked up a blueprint booklet and continued: "Now this set of prints makes up what we call a bill of material for a car. You'll notice that these forms contain a list of all the equipment on a given type of car, including detailed information that will assist in making out requisitions for the proper parts. Then we go on here (continuing to turn the pages) to a list of various castings, forgings and miscellaneous items with sketches of all these special parts. You'll notice pattern numbers for all castings are included. We have complete drawings of each of these patterns."

"That's very interesting," remarked Dick. "Now how do you apply this information?"

"Well, it's simply a process of elimination, once you have all the data in this form. By making very slight changes in design sometimes we are able to substitute one standard piece for several different varieties formerly in use."

"I follow you there, all right, but it looks like you'd still have to keep on ordering parts for the various cars in service, to have them all uniform in each car. Otherwise you'd have to scrap a lot of perfectly good material that is already on hand."

"That's true only to a certain extent. For instance, let's take this item of hand straps. We found that there were about 10 different types and lengths in our various groups of cars; in fact, just about as many different straps as there are types of cars. The store-room had to carry each type in stock for replacements, and at the same time the carhouses had to have some of each on hand. That meant that we were continually ordering small quantities of 10 different straps."

"When we studied this a little, we found that all our cars could be fitted with just two compromise types of straps. Then we made this sketch showing these two types, and a list of the cars in which each strap is to be used."

"What do you do when you have a car come in with one of the old straps broken?"

"I was just coming to that; it illustrates the principle of our entire practice. As soon as we had decided to use this new strap an engineering department instruction sheet was sent out to everyone interested, including storerooms, purchasing department and carhouses. Orders for replacement straps are limited to the new standard. When a car comes in with a broken strap, all those in that car are replaced with new ones. The old straps are put into stock and are used for replacements while they last. Then another car is stripped and the new standard is put in. So that way the process of substitution continues gradually, but all purchase orders are limited to the new standard part."

"That's fine," said Dick. "Will you let me have one of these blank bills of material forms?"

"Sure, help yourself. If you get into this subject, let me know if I can help you any further. Now if you'll come over this way we can see how it works out in the storeroom."

Car Maintenance Costs Reduced Since Last

FIGURES compiled by the Electric Railway Association of Equipment Men, Southern Properties, showing the comparative cost of car maintenance in January, 1925, and the same month a year ago, indicate a reduction of nearly 1 cent per car-mile. Six companies reported lower costs in January of this year and three had greater costs. The average was 24 cents per mile as against 24.98 cents. Figures for individual railways are given in the accompanying table.

MAINTENANCE COSTS PER 1,000 CAR MILES

	Jan., 1924	Jan., 1925
Memphis	20.49	19.72
Little Rock	23.30	20.22
Atlanta	19.37	22.41
New Orleans	22.27	22.85
Knoxville	26.87	23.05
Dallas (Texas Elect.)	25.39	25.04
Dallas	30.42	25.09
Birmingham	23.10	26.60
Chattanooga	31.82	31.07
Mobile	26.80	....
Average	24.98	24.00

Galvanized-Iron Sheets Used for Headlining

WHENEVER the headlining in cars operated by the New York & Harlem Railroad, New York, N. Y., requires replacing, No. 20 gage galvanized-iron sheets are used. For the average size car each sheet that is used is 24 in. x 96 in. Artificial lighting is by a row of lamps down

Above, Ceiling of Car with Galvanized-Iron Headlining in Place. Below, Ceiling Completely Finished with Lamps in Place.

the center of the car. The wires for the lighting circuits are inclosed in a trough and the bases for the lamps are mounted directly on the cover for this trough. Galvanized iron is used for the headlining as it has been found that it gives additional protection against deterioration.

Before the sheets are placed in position they are given a coat of Pratt & Lambert red primer on the upper side, and when they are in place the lower side is painted by a coat of red primer followed by a coat of Pratt & Lambert white enamel. This gives a smooth white surface which is a good reflector for the lighting. The accompanying illustrations show the galvanized-iron headlining in place and after it has been finished.

Cheap Concrete Setting for Poles

Old Paving Stones, Broken Concrete and Brick with Cement Grout Give Good Results in San Francisco

BY S. L. FOSTER
Chief Electrician Market Street Railway, San Francisco

UPON looking over an impressive list of 80 booklets relative to the various uses of portland cement recently, I was surprised to find no mention of the unusual use the Market Street Railway of San Francisco has made of cement in constructing the monolithic setting of its many thousands of steel and concrete poles for the past 23 years.

When a steel pole is set, it is raised or hoisted into the center of the hole dug in the ground. While it is held by pike—or fork—in the exact position desired, most companies pour and tamp concrete around the pole, this concrete being prepared manually or mechanically of the classical ingredients, namely, water, cement, sand and crushed rock or gravel and transported more or less from the point of mixing to the hole.

METHOD DISCOVERED ACCIDENTALLY

Owing to the non-arrival promptly of the crushed rock on a certain piece of pole setting work in 1902, the foreman of a gang doing this work on the Market Street Railway adopted an innovation that has since become our standard practice. From a near-by pile of rejected basalt or granite paving blocks he selected clean ones and packed the space tightly with these blocks between the pole and the sides of the hole. Then he mixed "grout"—cement, sand and water—in a large wheelbarrow at the edge of the hole and pouring it into the hole filled the interstices between the paving blocks, pole and sides of the hole with this "grout."

From that day to this no more premixed concrete has ever been used in our steel pole settings. Many of these settings have later been purposely demolished for various reasons, and invariably the exterior surface of the steel pole has been found perfectly preserved from corrosion and the cementing bond between paving blocks entirely satisfactory.

The proportions used in this "grout" has been one sack of cement to three sacks of sand and enough water to make it flow readily into the voids. No tamping is or could be done with this unfortunately but necessarily thin "soup." I know of no other electric railway company following our method of steel pole setting.

This method is as satisfactory as any other in furnishing the two objects of such a setting, namely, (1) providing a monolith about the lower part of the pole to present a broad surface over which to distribute the pressures against the soil produced by the leverages from the various strains applied to the top of the pole in railway work, and (2) inhibiting corrosion of the underground exterior surface of the steel pole.

It is economical of labor, as the throwing in of the paving blocks is simplicity itself while the stirring up of the "grout" in the wheelbarrow is done far more expeditiously than would be the case with the usual concrete mixture on a platform or in a concrete mixer. It is done exactly at the mouth of the hole, and the mixture is delivered into the hole the instant the proper consistency has been attained without any setting, any haulage cost, any tamping, any waste of cement or sand or any subsequent cleaning up of the street being required.

It is economical of material, as these old paving blocks, as used in San Francisco where blocks are continually being replaced by smoother paving, cost nothing beyond haulage and often are at hand when new track and pole construction are being carried on simultaneously. In other cases, instead of old paving blocks pieces of the excavated concrete base under bituminous paving, as removed by the track men to make room for ties and rails, have been used to fill the pole hole. This method saves not only the cost of the crushed rock but also the hauling cost of the crushed rock to the poles and the hauling costs of the condemned paving blocks or surplus concrete pavement base away from the street. After the great fire of 1906 bricks from the ruins were used with equally good results.

There is a still further advantage to this method of pole setting. As soon as the space between the pole and the sides of the hole has been packed full of the paving blocks or pieces of concrete pavement base, the pole is so firmly wedged in that the supporting pikes can be removed and usually the wire strains, if any, can be at once applied to the top of the pole. The pole is now practically set as far as resistance to the normal strains is concerned. The addition of the cement grout is really more to preserve the surface of the steel from corrosion than to provide rigidity for the setting, but this consideration should not lead one to use a cheap grout for the purpose. Poles have been found badly rusted where the proportion of cement had been abnormally reduced in the concrete used.

LABOR AND MATERIAL REDUCED

In brief, this San Francisco method improves the efficiency of steel pole setting in three essential features. It reduces the labor cost and the material cost, and it eliminates the former delay imposed on the linemen to permit the concrete to harden where the usual small-sized crushed rock is used instead of large paving blocks. Thus it expedites the work very materially.

As soon as the pole settings are grouted the span wires can be put up preparatory to stringing the trolley wire.

It is also found much easier to cut the pole setting off the pole with pneumatic chisels when paving blocks are used in the setting than when smaller pieces of stone are used.

Another favorable feature of this class of work in San Francisco by the ocean is that in the majority of holes clean sand is found entirely suitable for use with the cement. Thus the only transportation required for the concrete pole settings is that of cement and tools.

Cleaning Armature Cores by Sand Blast

IN THE shops of the Department of Street Railways, Detroit, Mich., a sand-blast method is used for cleaning armature cores and commutators before rewinding. This method takes but half an hour to clean an average size armature as against half a day previously required for a man to scrape, file and

Cleaning a Railway Armature by Sand Blast Previous to Rewinding

pick it clean. The sand blast is directed against the parts by means of a nozzle attached to a flexible hose, with an air supply and valve convenient to the operator for regulation. A suction hood takes the dirt and refuse from the armature out of the shop.

Causes for Lubrication Failure

RECOMMENDATIONS for packing bearings, together with causes for failure of lubrication in service, are given in a discussion of lubrication practices recommended for electric cars, which appears in the January issue of *Lubrication*, a publication of the Texas Oil Company. Armature bearings must be carefully machined and fitted on all surfaces. It is essential that they receive a sufficient and continuous supply of satisfactory lubricant and that they be packed and fitted in such a manner as to exclude dirt and water. Assuming that a high grade oil and proper waste saturation are used, the principal causes of apparent lubrication failure are enumerated as follows:

1. Shifting of the bearings in the housing, caused by the shearing of dowels or keys. This prevents the window in the bearing from registering with the window in the waste well, thereby shutting off the oil feed.

2. Distorted bearings which are caused by a fit too tight in the bearing housing. To guard against this, the overhauler should be sure that the armature can be turned by hand after assembling.

3. Loose or stretched housing bolts in motors of the split-frame type cause a bad fit between the bearing and the housing and permit the oil to escape outside the bearing. Shims for the purpose of taking up wear have the same effect. Their use should be avoided.

4. Improper alignment in reboring housings and bearings often causes tight fits and leads to failure. End play should be checked and particular attention given to keeping water out of the lubrication chambers, as this washes out the oil and causes glazing of the waste.

Experience has shown that within economical limits the wear is approximately inversely proportional to the quantity of oil applied. Dirt and water can be kept out of the bearings by proper maintenance of the dust caps and waste box covers.

Axle bearing wear is not generally considered so harmful as armature bearing wear, but it is the cause of many troubles. Excessive axle bearing clearances cause shocks and unnecessary strains in the motor frame, and on the axle cap and axle cap bolts. A change in the center to center clearances between the axle and the armature shaft causes the gears to spread beyond the normal pitch line and causes excessive wear of pinions and gears, due to a rubbing contact rather than rolling. Uneven wear of two axle bearings should not be tolerated.

Pull-Ins Reduced in Dallas

FOR the first time since the active campaign was started by the Dallas Railway to reduce pull-ins the number in one month was less than 100, the record for February showing but 91. Of these, 61 were chargeable to the shops and 30 to the transportation department.

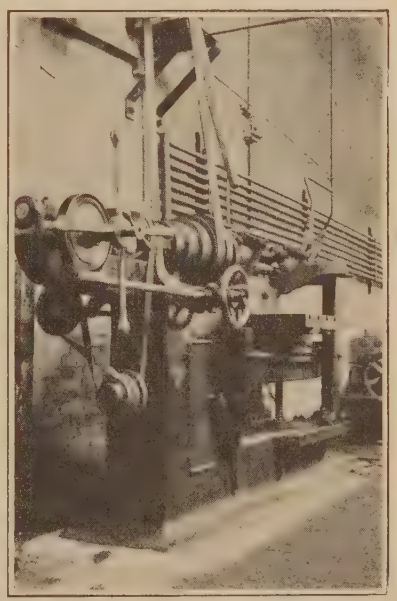
Mechanical pull-ins were: For fields, 31, armatures 10, brake rigging 9, air brakes and contactors 6 each, field jumpers 4, controllers 3, gearing, trolleys, brushes and holders 2 each, and for armature bands, bearings, motor leads, cables, circuit breakers, bells, seats, gates and journal boxes, 1 each. There were 5 unclassified.

Transportation pull-ins were: For accidents 14, unclassified 7, derailments and broken glass 3 each, found O. K. 2 and split switch 1.

Reconditioning Motors to Increase Bearing Mileage

RECENTLY the Eastern Massachusetts Street Railway made the first replacements of axle bearings on a group of small motors placed in service during the latter part of 1923. The average mileage per axle bearing was 125,000. In contrast to this the average life of axle bearings on several older type motors with shells more or less worn was found to be approximately 25,000 miles. In the case of the older motors, bearings had to be removed before they were fully worn on account of breakage, oblong dowel-pin holes, resulting from the loose condition of the bearings in the motor shell.

This convinced the company that in order to secure maximum bearing life the motors must be in first-class condition mechanically. As a result of a study of the subject a program of reconditioning motors by rebor-



Motors Are Rebored on This Machine in the Chelsea Shop of the Eastern Massachusetts Street Railway

ing is now under way at the company's Chelsea shops. It is expected by this procedure to triple the life of certain types of bearings.

One distinct advantage obtained by increasing the life of bearings is the fact that all bearing renewals can be made at the shops when cars are brought in for general overhauling, and thus eliminate the necessity of making replacements at the carhouses. One of the boring mills equipped with a special jig for re-

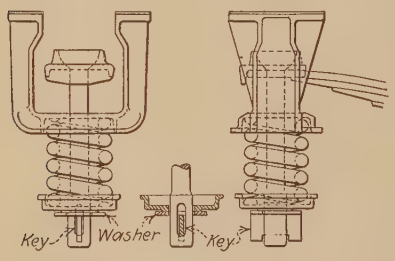
boring GE-247 motors is shown in the accompanying illustration.

In the case of this type motor the axle bearings were found to be too thin for satisfactory service. The diameter of the bearing is now being increased ⅛ in. with an allowance of 0.003 in. for clamping fit in the motor shells. To insure proper alignment each motor is fitted with a standard set of new armature frame heads before being placed in the jig. The motors are bored to provide interchangeability of the axle caps as heretofore. Direct labor cost of reboring the axle fits is $2.50 per motor, the work being done at the time the motors are overhauled.

New Equipment Available

Improved Swing Link

THE J. G. Brill Company, Philadelphia, Pa., calls attention to a new type of half-ball swing link that it has designed for suspending Birney safety car bodies from the



Changed Type of Swing Link for Safety Car Trucks

end quarter-elliptic springs of Brill 78-M and 79-E trucks.

This link forging is of the plain type and, instead of the threaded end with nut under the coil spring seat, a slot and key are used. This eliminates any difficulty which might occur from the nut rusting practically solid on the threaded link.

Limit Switch for Motor-Operated Shop Doors

A LIMIT switch has been designed by the General Electric Company, Schenectady, N. Y., for use with motor-operated doors and ventilator-opening equipment such as is used in many electric railway shops. The switch operates on the traveling nut principle, opening a circuit in either direction of travel, the distance of travel being regulated by means of an adjusting screw permitting calibration of from two to twelve turns.

Damage to the switch resulting from overtravel of the motor is prevented by allowing the traveling nut to leave the worm at the extreme ends, in which position further turning of the worm has no effect on the nut. When the direction of rotation of this worm is changed the nut is automatically re-engaged by means of a compression spring.

The switch is completely inclosed and the cover is held in place by four thumbscrews. Knockout holes are provided on the side for conduit wiring. The coupling is cup-shaped and slotted to engage a pin on the operating mechanism.

Due to the slow break of the contacts, the switch has been limited to 230 volts direct current, but can be used on 550 volts alternating current. The current-breaking capacity of the tip is limited to the current taken by the coil of a 75-amp. contactor on alternating current and an 80-amp. contactor on direct current.

Welding Flux Gives Strong Ductile Weld

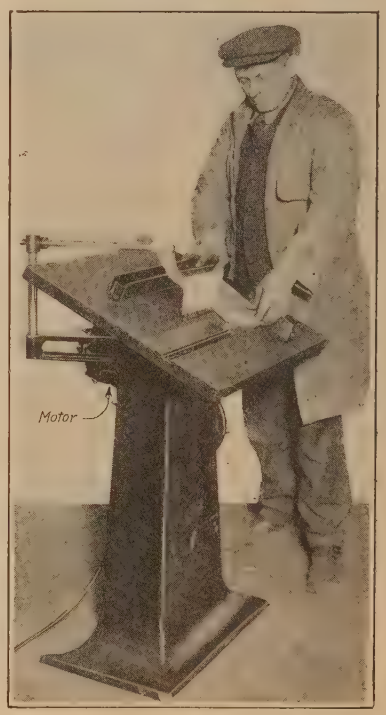
A WELDING flux known under the trade name of Welfex has been brought out by the Chemical Treatment Company, New York, N. Y. The manufacturer claims that this flux possesses several properties desirable for effecting a strong, soft and ductile weld which can be machined, faced or drilled without chatter or change of speed. The flux is intended primarily for gas welding. When using it, one end of the welding rod is heated by the torch flame and when brought to a cherry red is dipped in the flux, which fuses and forms a coating over the rod. The heat of the torch then causes the flux to flow from the rod to the weld. The end of the rod and the welding area should be kept well covered with this coating of slag.

It is stated that the slag which is produced not only protects but absorbs the impurities from the exposed surface of the hot metal, and that it also prevents serious changes of silicon or carbon content in the metal. Welfex is a desulphurizer, the affinity of its slag for sulphur being greater than that of the fused or molten metal.

Where welding is done on heavy pieces, additional flux should be added directly to the surface of the weld. With this method, care should be exercised to have the flux form a fluid slag of sufficient quantity to float over and completely cover the metal under fusion. This is essential, as the important service rendered by a fluxing slag is to dissolve metallic oxides and shield the molten metal from oxidation.

Universal Saw with Gear Drive

A UNIVERSAL saw, motor-driven through helical gears, is being marketed by R. L. Barker & Company, Chicago, Ill. The gears, which are exceptionally wide, are operated in oil. Ball bearings are used throughout. The driving equipment and the saw can be moved up



Universal Saw with Motor Drive

and down by turning a large hand wheel at the side of the machine. A heavy metal pedestal eliminates vibration and a guard for the saw is of efficient design. The table is 23 in. x 28 in. x 34 in. high and a saw 8 in. in diameter is used to provide a depth of cut of 2⅜ in. A ½-hp. motor is used for driving. The saw will cut wood, metals, bakelite and other compositions.

Association News & Discussions

Steam Railroad Engineers Hold Annual Convention in Chicago

American Railway Engineering Association and Signal Section Discuss Many Committee Reports of Interest to Electric Railway Men—National Railway Appliance Association Stages Annual Exhibit

SUBSTANTIAL progress in the study and solution of various railway engineering problems was evidenced throughout the annual meeting of the American Railway Engineering Association, held in Chicago, March 10 to 13. Attendance equaled the high record figure of last year, and the dinner on Wednesday evening taxed the capacity of the Congress Hotel Gold Room. The largest display of railway engineering material and appliances ever assembled was staged during the period of the convention by 176 members of the National Railway Appliance Association.

President Ray Urges Greater Co-operation and Increased Committee Activity

In his annual address to the association, President George J. Ray, chief engineer Delaware, Lackawanna & Western Railroad, attributed much of the progress made by the association to conscientious and enthusiastic committee work. Speaking of the present status of the railway industry, he said that although the total business handled by the railroads in 1924 was not quite up to that of the peak year of 1923, the month of October, 1924, showed a greater tonnage handled than in any preceding month in the history of American railroads.

"This vast tonnage," he said, "was handled without any material shortage of cars or power in any part of the country. At the present time the railroads are passing through one of the most interesting stages of their existence. During the past year we have seen some of the first moves toward consolidation under the transportation act of 1920.

"We will have to help build up some of these new combinations to a point where they are capable of handling the business and to maintain them in an economical manner and safe condition. We will be called upon to adjust the usual construction and maintenance programs to fit the new requirements and conditions."

Referring to the problems of maintenance, he urged that budgets be based on the requirements of the traffic and operating conditions over a period of years; so that maintenance programs would not fluctuate with short periodic changes in volume of traffic. Mr. Ray summarized this by saying, "There should be a reasonable maintenance standard for every individual property. This standard should be based upon the general earning capacity and also upon the kind and class of traffic handled. With this standard correctly fixed, slight fluctuations in the business should not materially alter the yearly program of maintenance work."

On the subject of automatic train control he urged that railway construction, maintenance and operating men co-operate in studying and analyzing the various types of control that have been installed on several trunk lines during the past year in compliance with orders of the Interstate Commerce Commission. He also advocated that the railroads of the country take the initiative in collecting data to be used as the basis of eliminating unnecessary grade crossings.

At the meeting on Wednesday J. M. R. Fairbairn, chief engineer Canadian Pacific Railroad, was elected president for the ensuing year. Various committee reports presented during the session contain information of interest to electric railway engineers. These include the following:

Committee Reports of Interest to Electric Railways

Electricity.—The subjects covered were water power, electrolysis, transmission lines and the joint use of poles. Revisions were made in the specifications for the construction of overhead electric supply lines. Specifications were prepared covering the maintenance of transmission lines and the joint use of poles. These are designed for the guidance of forces engaged in maintaining railroad electric supply lines located on railroad property. Standard practices to be followed when wooden pole lines are used for both electric power transmission and distribution circuits, and for signal and communication circuits, are also compiled.

Ballast.— Specifications for stone ballast were presented with a recommendation that they be substituted for the present specifications in the manual. It was recommended that the design of the 15-tine ballast fork adopted in 1924 be withdrawn from the manual because this fork cannot be produced commercially. Investigation showed that the railroads do not favor different sizes of stone for different characters of traffic. It was also concluded that there is no particular advantage in smaller sized ballast from the standpoint of collecting dirt. Consequently it was decided to make ¾ in. the minimum and 2½ in. the maximum sizes for ballast. It was also concluded that rock meeting the requirements for weight, toughness, soundness, wear and cementing qualities would necessarily be satisfactory in strength, absorption and solubility, and these last-named tests were, therefore, omitted from the proposed specifications. No definite rules were offered on the subject of ballasting by contract, but the committee submitted as information a typical form of contract and specification which has been used successfully by one road.

Masonry.—Last year's unfinished report on the principles of design of plain and reinforced concrete for use in railway structures was completed. It was submitted with the recommendation that it be included in the manual. The report called attention to the lack of reliable information as to embankment pressures on culverts under deep fills and the committee therefore limited its study to vertical loads. Rules for the inspection of masonry structures were also included in the report.

Economics of Railway Location.—A progress report included methods of estimating speed, time and fuel consumption on lines to be constructed or revised. An outline of the computations for the speed curve method was given, together with a modification of this method, especially adapted to computing the values of rise and fall. It was pointed out in the report that speed should be differentiated as between that based on running time between stops and the speed based on the elapsed time between terminals. In view of the many variable contributing conditions, no definite method was given for estimating delays, except that of studying past performance under similar physical operating and traffic conditions.

Buildings.—The committee recommended that the specifications for concrete roofing tile, display roofing tile, electric light wiring, hot air heating, hot blast heating, architectural terra cotta and concrete architectural stone, as presented in the 1923 report, be approved for publication in the manual. The conclusions of the committee relative to floors for freight houses and location and design of passenger stations were submitted for inclusion in the manual. Data covering the ventilation of railway buildings were also presented as information.

Stresses in Railroad Tracks.—This committee submitted a progress report based on four years of study in co-operation with the American Society of Civil Engineers. The report gave further data on stresses in tracks produced by the action of steam and electric locomotives. It also included the

first scientific study of the effects upon rail and upon track maintenance, resulting from the canting of rails inward. A general discussion was given of tests conducted on the Chicago, Milwaukee & St. Paul Railway.

Co-operation with Universities.—Stimulation of a greater interest and appreciation of the value of technically trained men in railway organizations was the purpose of this committee. Its further object was to secure a more general application of laboratory and other university research facilities to the solution of railway problems, and at the same time to stimulate a greater interest among engineering students in transportation as a future vocation. A progress report was submitted carrying on further the work done in previous years.

Economics of Railway Operation.—The report of this committee included an analysis of the effective speed upon the cost of transportation. It also presented further data on methods for increasing the traffic capacity of a railroad, and an analysis of costs as applied to starting and stopping trains.

Roadway.—Information reports were submitted on corrugated metal culverts, methods of handling the problems resulting from slides and water pockets, and methods of keeping down dust on road crossings and platforms as well as on tracks.

It was pointed out that when the roadbed shoulder is built up with clay or other impervious material, a pocket which holds water is formed under the track. It was recommended that cinders or some other porous material should be used to build up the roadbed shoulder instead of clay or other like material. When it becomes necessary to use impervious material, the committee stated that suitable cross-drains should be placed to prevent water pockets.

Spraying with crude oil was found to be the most general method used for the elimination of dust. It was also found, however, that several railroads have discontinued this practice. In some cases oiling of the roadbed was unsatisfactory for a number of different reasons. It seemed to be the general opinion that oiling of the roadbed is advisable in sandy desert regions where the rainfall is very light, but that the results are much less satisfactory in districts having a nominal amount of rainfall. There seemed to be a general agreement that station and freight yard driveways can be oiled to advantage and that the same is true of highways at crossings or points adjacent to railroad tracks.

Wood Preservation.—The committee on wood preservation reported under six heads. This included revision of the manual, service test records on ties and fence posts, treatment with a mixture of creosote and petroleum, treatment with a mixture of chloride of zinc and petroleum, marine oiling research and the effect of preservatives on the inflammability of wood.

Owing to the increased use of treated timber and the decreased quantities of creosote which are available, the question of the suitability of mixtures or combinations with other preservatives was considered particularly pertinent. The report continues the study of this subject from last year. For inclusion in the manual specifications were submitted covering thermometers used in creosote distillation and also a method for the analysis of zinc chloride.

During the past year a process was developed at the Mellon Institute of Industrial Research, Pittsburgh, Pa., by means of which zinc chloride and petroleum is injected into the timber in the form of an emulsion composed of zinc chloride solution of 15 to 40 per cent strength and a mixture of heavy asphaltic base petroleum thinned to the density desired. The results obtained from the zinc chloride petroleum treated ties indicated that the addition of the petroleum to zinc chloride will, under most conditions, add to the life as compared with zinc chloride treatment only. The report stated that experimental work along this line carried out during the past year has been very encouraging.

Shop and Locomotive Terminals.—Among several subjects studied by this committee was included the general layout and design of car shops. This was treated from the standpoint of steam equipment conditions, but allowance for the differences in clearance required would permit these recommendations to be readily compared with electric railway practice.

Signals and Interlocking.—The report of the committee on signals and interlocking contained voluminous information on automatic train control and signals for highway crossing protection. In treating automatic train control, the committee outlined six important phases of the subject but confined itself this year to a detailed report on but two of these, namely, (1) the purpose of train control and historical data; (2) the extent to which wayside signals may be omitted in train-controlled territory.

The several sections into which the complete report will be divided are as follows:

The purpose of train control and historical data.

Definitions.

The effect of train control on train operation.

The comparative control furnished by various types of train-stop and train-control devices.

The effect on signal systems of installing train control.

Extent to which wayside signals may be omitted in train-controlled territory.

Iron and Steel Structures.—A number of revisions of the manual dealing with the general specifications for steel railway bridges were prepared. Certain portions of the manual, nullified by the adoption of the general specifications for the erection of steel railway bridges, are to be removed. In addition, the report includes rules for the field inspection of existing bridges, a statement relative to the status of the specifications for steel highway bridges now before a conference committee of the American Railway Association, the American Society of Civil Engineers, and the Association of Highway Officers.

Uniform General Contract Form.—A form of option for the purchase of land and a form of agreement for the joint use of passenger station facilities were presented by the committee. There were also included in the report for information and discussion forms of agreement for the purchase of electrical energy, for the joint use of freight station facilities and for joint pole lines. The committee reported on the result of the joint conference on standard construction contracts to which its chairman was a delegate.

Yards and Terminals.—This year the committee has carried forward its detailed studies of the relation between passenger station facilities and business handled, to include an analysis of the problem of handling commuter traffic as contrasted with through traffic. In addition, a detailed report was submitted on the handling of freight, dealing particularly with the economics of various types of freight houses and involving both operating and investment charges. Curves were presented in the report showing the comparative investment per ton for outbound and inbound houses.

Ties.—Further study of substitute ties was covered by a section of the report dealing with the principal causes of failure of substitute ties and methods whereby these might be overcome. Suggested designs were submitted with the recommendation that interested roads build and test these types under different track conditions. Foreign woods for tie purposes were discussed and conclusions were submitted for inclusion in the manual. A specification for tie plugs was also prepared.

Economics of Railway Labor.—A discussion of standard methods for performing maintenance-of-way work and of methods of programming this work were included in the report. The first portion of this discussion deals with the establishment of standard schedules as units of performances for the purpose of securing the most effective organization of the maintenance forces. Such necessary factors as budgets, equalization of expenses, division programming and the relation of these factors to the economical application of labor are discussed in the second portion of the report.

Records and Accounts.—The work started last year on cost-keeping methods and statistical records for the purpose of securing unit costs was discussed in the report. Three different classifications were presented as a basis for separating the cost figures. These included studies of maintenance costs from the I.C.C. primary accounts, from sub-primary accounts and from special studies. The committee concluded that cost keeping and statistical records are practical and result in economies, by facilitating the control of expenditures.

Signs, Fences and Crossings.—This committee prepared definitions of bituminous materials and specifications for bituminous crossings, for approval and publication in the manual. It submitted a progress report on the elimination of highway grade crossings and also compiled information outlining the methods followed by the various states in apportioning the cost of highway improvements adjacent and parallel to railroad rights-of-way.

Tracks.—An amended table of temperature expansions for laying rails, which gives values for 39-ft. and 45-ft. rail, was presented for revision of the manual. Detailed plans of certain types of crossings, compromise joints and compromise rail were submitted for adoption. The committee recommended the practice of canting rail inward at the rate of 1 in 20. Figures were prepared showing the comparative cost of resawing, rerolling and building up rail ends by the oxy-acetylene process. Data on track construction in city streets were included.

Rail.—This committee presented new specifications for rail in which the non-essential features heretofore causing dissension between rail manufacturers and railways have been eliminated. It also submitted a progress report for track bolts, and suggested a method of compiling statistics based on a traffic density factor.

Wooden Bridges.—A record of progress on the study of the useful strength of new, old and treated timber in railway trestles, and a critical examination of the present series of stresses when applied to timber under railway load conditions, were contained in the report. There was also a classification of the uses of timber and lumber under A.R.A. specifications. Attention was directed to the standardization program developed by the timber industry, resulting in the American Lumber Standard Recommendation No. 16 of the U. S. Department of Commerce. The committee also reported on the relative merits of open and ballasted deck timber trestles.

Central Electric Railway Association Master Mechanics Organize

New Association Will Be Affiliated With C. E. R. A.—Purpose Is to Consider Methods of Improving Equipment Maintenance Practice and to Work Toward Greater Uniformity as a Means of Expediting Interchange

EQUIPMENT men in the territory covered by the Central Electric Railway Association met at Lima, Ohio, on March 12 and organized the Central Electric Railway Master Mechanics' Association. This is the result of a movement started shortly after the last annual meeting of the C. E. R. A., at which time some of the equipment men felt that they would derive greater benefit from meetings devoted entirely to equipment subjects than from the procedure as followed in the Engineering Council. Approximately 30 equipment men attended this first formal meeting of the new association, and a special committee appointed by the executive committee of the C. E. R. A. sat in during part of the session, to outline the views of the executive committee relative to the new organization.

Need for Master Mechanics' Organization Outlined

T. H. Nicholl, superintendent of motive power Union Traction Company of Indiana, who presided as temporary chairman, opened the meeting by stating the need for some more closely knit organization of equipment men than had been offered by the engineering council. The object of this movement, according to Mr. Nicholl, was to make possible an intensive study of mutual equipment problems, to raise the standard of equipment maintenance on the member roads in the territory, and to expedite the interchange of equipment through greater uniformity of practice.

He pointed out that the best results from the standpoint of improvement in practice could be accomplished through the medium of an exclusively mechanical men's organization, rather than through the existing engineering council. This was held to be due primarily to two reasons; first, the saving in time resulting from confining the discussions to equipment subjects entirely, and second the simplified organization that would result from the elimination of the geographical subdivisions into which the engineering council was divided.

G. R. Green, general superintendent Chicago, South Bend & Northern Indiana Railway, made an impassioned appeal for a full recognition of the importance of the master mechanics' duties on electric railways in general and particularly those engaged in the interchange of equipment. He maintained that methods of improving the service to shippers should receive the utmost consideration by all departments of the various roads in the territory. He held that this would mean increased freight business, particularly in the C. E. R. A. district, and consequently considered it of vital importance to the very life of the industry.

Mr. Green spoke highly of the past work of the Engineering Council. From the equipment man's viewpoint, however, he said that the concrete results accomplished had been limited, due to the short time available for the consideration of track and overhead line subjects along with those of the mechanical department. Through a master mechanics' association the mechanical men had felt that they would have more time available to work out their specific problems. He maintained that the master mechanics are in position to make substantial savings in costs through comparison of practices and interchange of ideas for improvement. He suggested that by holding meetings at various points in the territory at least a part of the time available could be used to visit the shops of member companies, thus better to compare practices and take advantage of new methods and ideas.

The same line of thinking was expressed by E. B. Gunn, superintendent of equipment and transportation Western Ohio Traction Company, who had undertaken the work of sending out notices for this meeting. He said that it was the intention to make these strictly business meetings, and that attendance by representatives of manufacturers would be limited to those in position to assist directly in the work of the association. He added that it would be the practice to discourage entertainment of any kind, so that the time available for meetings could be used to the greatest possible advantage.

According to all three speakers, it was the desire and intention of the master mechanics to maintain a close affiliation with the C. E. R. A. They explained that the meeting in progress had been called for the purpose of working out a concrete plan which would then be submitted to the executive committee of the C. E. R. A. for approval before going ahead.

G. K. Jeffries, general superintendent Terre Haute, Indianapolis & Eastern Traction Company, representing the executive committee, said that it was inclined to commend the master mechanics for the initiative and enthusiasm which had led them to go ahead with plans for a better way of doing their work. He felt sure the executive committee would approve the proposed form of organization, affiliated with the C. E. R. A.

Brief addresses were also made by F. D. Carpenter, president Western Ohio Railway; M. Ackerman, general manager and purchasing agent Cincinnati & Dayton Traction Company, and K. A. Simmon, representing M. B. Lambert, Westinghouse Electric & Manufacturing Company. Some of these speakers expressed the thought that the interests of all concerned would be served best by making the master mechanics' organization one section of an engineering group which would include the maintenance of way and

RULES FOR INSPECTION OF INTERCHANGE EQUIPMENT

Wheels

A. Tread thickness measured 1 in. from edge of rim shall not be less than ⅝ in.
B. No wheels must have over ⅛ in. hollow tread.
C. Flanges not less than 1⅛ in. thick.
D. Treads not to be over 3⅞ in. wide or under 3 in. at any point.
E. Must not have chipped flanges more than ⅝ in. wide by 1½ in. long.
F. Steel wheels must not have a flat spot over 2 in. long and cast-iron wheels must not have a flat spot over 1 in. long.
G. Wheels must not be less than 54 in. inside measurement at gage line.

Couplers

A. Knuckles must not be over 5¼ in. from face to contour of coupler.
B. Locking device must come within 2 in. of knuckles.
C. Minimum height 31½ in., maximum 34½ in. under any condition of loading.
D. Anchor must not be loose and no anchor bolts missing.
E. No cracks or defects on knuckles or drawbars or anchors.

Trucks

A. Side bearings to have at least ⅞ in. clearance under load.
B. Center bearings must be O. K. and well lubricated.

Brakes

A. Not over 8 in. piston travel under load.
B. Heads, beams, pins, rods, hangers, etc., must be in good repair.
C. Hand brake must be efficient and in good repair.

U. S. Safety Appliances Standard

A. All cars must be properly equipped with United States Safety Appliance Standards.

power distribution men. The equipment men, however, felt that the others should take the initiative on their own account in forming themselves into similar groups.

A constitution which had been prepared by a special committee was read and adopted, and was then turned over to the secretary for submission to the C. E. R. A. executive committee. This provides for three grades of membership, namely, active, associate and honorary. Membership in the first grade, the only one permitted to vote and hold office, is limited to those in active charge of the maintenance of equipment on member roads of the C. E. R. A., and their principal assistants. Not more than two persons from any one property can hold active membership. Associate membership is open to mechanical department foremen, inspectors, etc. Honorary members are to be elected by the executive committee.

Rules for the inspection of interchange equipment were taken up, discussed in detail and adopted. These rules are published on page 477. An evening session was devoted to a detailed discussion of a code of rules governing the condition and repairs to freight cars for the interchange of traffic. This was designed as a guide for the adjustment of questions arising between car owner and handling road.

A special committee was appointed to prepare a schedule of uniform charges for the repair of equipment on foreign roads. Standing committees on standardization and on subjects were also appointed.

The following officers were elected to hold office until the next regular meeting: T. H. Nicholl, president; P. V. C. See, vice-president; L. E. Earlywine, secretary and treasurer; E. B. Gunn, F. J. Foote, Fred Heckler and J. W. Osborne, members of the executive committee.

The next meeting will be held at Fort Wayne, Ind., on April 9.

American Association News

Power Transmission and Distribution

THE midyear meeting of the power transmission and distribution committee was held in Chicago on March 9 and 10 with the following members present: Charles H. Jones, chairman; J. Walter Allen, J. C. Damon representing W. H. Bassett, M. W. Cooke, S. M. Day, J. H. Drew, D. D. Ewing, Charles Gilman, H. W. Griffin, C. L. Hancock, C. J. Hixson, W. E. Huber, Adrian Hughes, Jr., John Leisenring, F. McVittie H. S. Murphy, C. P. Nachod, J. F. Neild, W. J. Quinn, W. Schaake, A. Schlesinger, J. M. Waldron, F. J. White.

The Monday sessions were devoted exclusively to meetings of sub-committees. Considerable progress was made at these meetings in the compilation, preparation and discussion of reports on the various subjects assigned to them. The general meeting of the committee was held on Tuesday. In order to conserve the time it was decided to proceed with the business of receiving progress reports of the various sub-committees.

Mr. Waldron, chairman of the sub-committee on revision of signal sections of the manual, reported progress on the standardization of aspects for signaling.

For the sub-committee on concrete pole design Mr. McVittie, chairman, reported that three meetings had been held and a tentative report had been prepared which contemplates leaving out a considerable portion of the text matter in the present manual section. This committee has decided to conduct a series of tests on poles now in general use and will include the results of these tests in its final report.

It was planned to conduct all of these tests on octagonal poles, but Mr. Hughes kindly offered to conduct a similar series of tests on square poles. The same general rules and calculations that apply to octagonal poles also apply to the hexagonal and round poles and with the addition of the data accumulated from the square poles the report of this year's committee will undoubtedly be very complete on this subject. It was the opinion of the committee that the time was not ripe for the development of an A. E. S. C. standard as the concrete pole was largely in the development stages.

Mr. Murphy reported that a meeting of the sub-committee on trolley wire wear and specifications had been held in New York a few days previous with the corresponding sub-committee of the American Society for Testing Materials. A definite agreement was reached on the hard drawn trolley wire specifications. The specifications as prepared by the secretaries of the two organizations were modified to a small extent by the addition of paragraphs pertaining to the reeling of wire and the modification of the paragraph referring to the twist test. Mr. Jones stated that with approval of both associations these changes bring the A.E.R.E.A. specifications for hard drawn trolley wire into complete conformity with the A. S. T. M. specifications.

At the meeting in New York of the sub-committee of the two associations considerable progress was made in the development of a high strength trolley wire specification. It was agreed to set up two different strength specifications, one to be referred to as high strength bronze wire and the other to be referred to as medium strength bronze wire.

It was impossible to come to any agreement with the A. S. T. M. on the twist test for a high strength wire. After considerable discussion on this subject it was the opinion that unless the A. S. T. M. saw fit to alter the stand its sub-committee has taken a high strength specification should be developed by the power transmission and distribution committee.

Mr. Murphy stated that very little progress was being made on the question of current collecting devices, on which subject a corresponding committee of the equipment committee was also working. He also stated that some additional data had been gathered on the subject of trolley wire wear and it would be compiled in time for the inclusion of the report of the committee in June.

Mr. Neild submitted a definite report on temporary connections to trolley wire, which recommended the use of two devices, one of which had to be removed in order to permit a trolley car to pass, while the other one could be left on the wire while cars passed underneath it. This report was accepted for final submission to the committee in June.

Mr. McVittie stated that considerable discussion had taken place regarding specifications for trackless trolley overhead construction and that the committee now had before it a tentative set of specifications which outlines general construction details. Since comparatively few installations of trackless trolley were being made the committee did not feel that a very extensive and comprehensive set of specifications was required at this time.

Mr. Allen reported that the committee on return circuits had arrived at certain conclusions as to the number of bonds, types of bonding and place of attachment to the rail and that a report was in process.

Mr. Jones stated in the present specification for direct suspension overhead construction, which has been adopted by the A. E. S. C. as a tentative American standard, are a great many construction details which apply also to catenary suspension. It was his opinion that while it should be desirable to consolidate the specifications for both types of construction in the one specification it was not advisable to do that at this time. Mr. Jones suggested that it would be better to prepare a separate specification for catenary overhead and include in it those portions of direct suspension specification that were applicable. Such a specification will be ready for final discussion of this committee prior to the June meeting.

Since the organization meeting of the committee in December the executive committee has assigned the subject of radio interference for investigation. After some discussion a sub-committee consisting of W. J. Quinn and J. F. Neild was appointed.

As a result of a discussion on protcetive coatings for iron and steel it was agreed that the manufacturer representatives present, who were interested in galvanizing work, would gather together information relative to the various tests which might be used in determining the quality of galvanizing.

On March 5 and 6 a meeting of the A. E. S. C. sectional committee was held in New York on revision of parts two and four of the National Safety Code. The association was represented at this meeting by C. R. Harte, R. W. Eaton and M. B. Rosevear.

The News of the Industry

Franchise Progress in Kansas City

New Grant Which Will Provide for Bus Service Ready to Go Before Council

At the meeting on March 9 of the committee of the Council of Kansas City, Mo., which has before it the ordinance to establish conditions under which the Kansas City Railways is to be allowed to operate buses in auxiliary service, a further delay of one week was arranged before the final draft of the ordinance is placed before the entire Council for a vote. It is six months since the railway first applied for permission to run buses in service auxiliary to the railway.

At the outset receivers for the railway were several weeks in coming to any agreement with the Council in regard to the life of the franchise. Time limits running all the way from three to twenty years were discussed before a franchise to run for three years was finally agreed upon. City officials contended that inasmuch as the average life of a bus is approximately five years, a trial period not to exceed five years should be allowed. The railway receivers argued against the short-term investment involved in a temporary franchise.

Once the time limit on the franchise had been arranged and announcement made of the routes tentatively established for the nine services, but further delays were experienced because disagreements arose anent the proposed routings. Loading zones were asked for at the Union Station, but they were protested by the Kansas City Terminal Railway, which controls the station, and by the attorneys for the Yellow Cab & Baggage Company. An express line to and from the Country Club districts is planned and has been much discussed and argued against by Aldermen and citizens from various other sections of the city, particularly on the score of the 25-cent fare which is presumably to be charged for this service.

Even now, with only a few minor points in the ordinance to be settled and the bill passed and signed, it is probable that the first of April will have gone before the Kansas City Railways may be free to carry out plans, purchase buses and start the proposed service.

A period of two weeks is required to put an ordinance through the Council in the event no objections or arguments are raised. After that has been done the receivers will be obliged to present the plans to Judge Kimbrough Stone, referee, for his consideration and approval or rejection. If all the remaining obstacles are quickly surmounted, regular service by bus may be in operation in Kansas City, Mo., some time in May or June, it is said.

The railway is operating a regular service with six buses in Kansas City, Kan., carrying traffic in the outlying district of Argentine to the present terminal of intercity car service over the viaduct.

Transit Survey of Cleveland Proposed

Cleveland and its suburbs are seeking to co-operate with a view to treating the transportation problem in the metropolitan area of Cuyahoga County as a whole. With this thought in mind, a transportation committee for the metropolitan area of the county has just been named, with Alfred R. Horr, vice-president of the Cleveland Trust Company, as chairman.

Mr. Horr has just returned to Cleveland from New York, where for ten years he was vice-president of the Equitable Life Assurance Society. He has been a director of the Third Avenue Railway, the Coney Island & Brooklyn Railway and the Brooklyn City Railroad. Mr. Horr says that his committee will attempt to solve the transportation problems of Greater Cleveland, which includes the suburbs, instead of Cleveland alone. To do this, it may be necessary to amend the Tayler service-at-cost franchise under which the Cleveland Railway is run.

Serving with Mr. Horr on the committee are the Mayors of Lakewood and Cleveland Heights, one of the East Cleveland city commissioners and two Cleveland Councilmen.

Buses Regulated in Indiana

Motor Carriers There Placed Under Commission Regulation—Certificates of Convenience and Necessity Provided —Permits to Operate Transferable

BUSSES and trucks operated for hire in Indiana have been brought under the jurisdiction of the Public Service Commission. The bill to that effect has been signed by the Governor. The measure is a compromise. Traction interests arrayed themselves behind the so-called Moorehead bill as best designed to accomplish the degree of responsibility that they thought ought to be assured by the proposed legislation. The bus interests, as two years ago, protested on the ground of the alleged severity of that measure, saying that strangulation would result under the imposition of the Moorehead bill as presented originally. They introduced a bill of their own which called for regulation by the State Highway Department.

The new law is to supplement the public utilities law, which gives the commission power to adopt rules and regulations to govern applications for certificates of public convenience and necessity. The original bill required that all bus and truck operators should be compelled to obtain certificates of convenience and necessity from the commission and required the commission to give "consideration to the service rendered in the territory by steam and electric railroads and other motor vehicles." The words "steam and electric railroads" were stricken out of the bill by the House, making it within the power of the Public Service Commission to consider only the existing motor lines in the territory in determining whether or not an applicant is entitled to a certificate for operation.

The Senate amended the Moorehead bill so that all bus and truck companies in operation over fixed schedules 90 days prior to the taking effect of the act would be entitled automatically to certificates of convenience and necessity. Bonds which will guarantee the payment of damages if caused by any vehicle through careless operation must, however, be filed with the commission before the certificate may be granted. By an amendment made in the House these bonds may be taken out in mutual associations or reciprocal exchanges, but they are to be subject to the approval of the commission.

Permits to Operate Are Transferable

By another amendment made in the House the certificates granted by the commission may be sold, bequeathed or transferred just as is any other property. It has been pointed out that after all existing motor transportation companies have received certificates it is reasonable to assume that few occasions would ever arise by which a bus company would come before the commission with an application for a certificate, since the rights can be bought and sold.

Where bus companies already are in operation in cities or towns continuous thereto under contract the Board of Works or Common Council may continue to supervise, control and contract for such service and determine when, if at all public convenience and necessity, require that competing service shall be established. The determina-

tion of any such board or Council may, however, be appealed for review to the Circuit or Superior Court of the county within 20 days. The penalty for violation of any of the provisions of the law is a fine of $10 to $100 for each offense, each day constituting a separate offense. The commission also may cause any certificate to be revoked. Each section of the law is independent of the other.

The original bill was introduced by Senator Robert L. Moorehead, Marion, Republican. It was based on the recommendations of the Bus Regulation Survey Commission, which worked under A. M. Glossbrener, Indianapolis, at the instance of the State Chamber of Commerce. The Indiana Highways and Motor Association, led by Samuel E. Hadden, secretary, and Robert I. Marsh, attorney, fought for the amendment to the bill along with other motor bus owners and the associations representing the motor carriers.

Conference Proposed on Conditions in Buffalo

Herbert G. Tulley, president of the International Railway, Buffalo, N. Y., continues to ignore the insidious threats and charges made by the politicians. He has, however, informed the City Council that the railway will not commit itself to any paving or track reconstruction. He says that the criticism of the railway is having a serious effect on the ability of the management to raise funds for necessary improvements.

The Chamber of Commerce has asked the Public Service Commission to investigate service conditions so that "necessary steps can be taken to compel the company to give such additional service as may be required." As a result William R. Pooley of the Public Service Commission says a survey will be made by the commission to determine the adequacy of the service in Buffalo. The commission also has called a conference to be attended by the municipal authorities, President Tulley of the International and Thomas E. Mitten, Philadelphia, of Mitten Management, Inc. It is to be held March 25 in Buffalo.

Mayor Schwab continues his threat to declare a transportation emergency in Buffalo so as to enable him to permit the return of the jitneys in an effort to force the company to operate more cars. The railway says this plan will only tend to reduce the company's revenues and force a fare higher than 8 cents, the rate authorized by the commission.

An appeal from the 8-cent fare is being considered by the City Council. Dr. Milo R. Maltbie, the city's utility expert, has made a report on traction facilities in Buffalo, but his findings have not been made public. It is reported, however, that Dr. Maltbie has recommended that no appeal be taken from the 8-cent fare decision of the board because of the fear that a review by the commission might result in a fare still higher than that now in effect. Some members of the commission are said to feel that the fare was based on a valuation of the company's property in Buffalo that was too low.

Jitneys Regulated in Terre Haute

Protest of Merchants Results in Ruling Autos Off Street Car Streets—Ordinance Provisions Summarized

Objection by merchants along Wabash Avenue, the main street in Terre Haute, Ind., to jitneys has resulted in the City Council passing an ordinance which prohibits jitneys from parking longer than 5 minutes on a street in the congested district and from receiving or discharging passengers on any street upon which an electric railway operates.

The protest was against the great amount of parking space occupied by jitneys operating on six lines, four of which paralleled street car lines. More than two blocks of curbing was used by the jitneys, barring customers' automobiles.

Immediately upon enforcement of the traffic ordinance the Terre Haute division of the Terre Haute, Indianapolis & Eastern Traction Company entered four large buses in competition with the jitneys which were operating. On all lines but one the jitneys were ordinary sedans or California-topped automobiles. The railway buses are front-entrance type, one-man operated, with pay-enter cash fare boxes. Transfers are issued from cars to the company buses and vice versa.

The new traffic ordinance, of which only one of twenty-six sections applied to jitneys, had been in effect about a month when G. O. Nicolai, manager of the Terre Haute division, announced on March 12 that additional buses had been ordered by his company. At that time the company's two bus lines were being operated on 15-minute schedules. Mr. Nicolai declined to say whether a new line was to be started or a closer schedule instituted on the present service.

JITNEY MEN SEEK AID OF COURT

Following is the section of the traffic ordinance regulating the jitneys:

(Passenger-Carrying Vehicles — Other than Street and Interurban Cars—No person, firm or corporation operating any jitney, city bus or interurban bus for hire shall receive or discharge any passengers upon any street, avenue or roadway at any point thereon upon which there is located any street car tracks or track, upon and over which street or interurban cars are regularly operated.

No street car, interurban car or vehicle for hire shall remain standing on any street within the congested district for the purpose of receiving or discharging passengers for a period exceeding 5 minutes at any one time.

Provided that none of the provisions of this section shall apply to any taxicab, or owner or operator thereof, when such taxicab is operated only upon a specific call by telephone or otherwise under a specific contract for hire, from a public or private garage or station maintained for the purpose of receiving such calls, and the destination of which taxicab is wholly under the direction of a passenger or passengers transported therein and the route of which is over any street or streets available for travel thereto; nor any vehicle, nor the owner or operator thereof, when such vehicle is operated by a hotel owner in the conveyance of guests between such hotel and any railroad or interurban station.

Immediately upon passage of the ordinance the operators of the jitneys sought and obtained a restraining order against the city to prevent enforcement of the measure until a hearing was had on a petition for an injunction. In the Vigo County Superior Court No. 2 the injunction was denied. The court held that a City Council had the right to determine how each street was used.

Indiana Interurban Reduces Fare as Experiment

The Indianapolis & Cincinnati Traction Company, Indianapolis, Ind., has decided to reduce fares for a month as an experiment. In the past the rate has been 3 cents a mile. The new rate will be 2 cents for 30 days, but only on round trip tickets. One-way tickets will sell for the old rate.

The company had been making Sunday excursion fare concessions for some time. These have proved so beneficial in creating new business that it was decided to extend the reduction to week days to see whether the results would be proportionately as great. The company hopes to appeal to the public to make more general use of the railway and is directing attention to the advantages which are offered by the new rates.

Although the move by the company is entirely independent on its part, it is said that other interurbans of Indiana are awaiting with interest a report on the outcome of the reduced tariff test to see whether earnings are increased without any undue increase in operating expenses.

Financial Backers of New Missouri Road Not Disclosed

George R. Collins, Kansas City, who said he was general manager for Lee Dunlap, principal promoter of the proposed St. Louis-Kansas City Short Line Railroad, testified on March 6 that he was first approached on the subject of an interurban line between the two principal Missouri cities by George Harrison, vice-president of the New England Bank, Kansas City. Mr. Harrison told him that his father, a banker at Glasgow, Mo., was promoting the road and had invested $35,000 for preliminary work, but that he wanted help. This talk took place nearly 10 years ago. The project was permitted to slumber during the war, but Mr. Harrison and his associates recently interested a syndicate in the proposed road.

Charles Miller, counsel for the Chicago & Alton, sought to obtain the names of the members of this syndicate, but Mr. Collins declined to furnish them. Finally, on advice of L. C. Boyle, attorney for the promoters, he furnished the names of the officers of the new line. They are: E. W. Lawhorn, St. Joseph, president; Lee Dunlap, second vice-president; W. H. White, St. Joseph; W. R. Cawthorn, Columbia; Dr. H. K. Gibbins, Fayette, and State Senator Walter Brownlee, Brookfield, directors.

Mr. Collins stated that the new road, a 238-mile system, will be 40 miles shorter than the Wabash, the shortest steam road between St. Louis and Kansas City. It will serve nineteen towns now without railroad facilities. It will be equipped with electricity.

Hearing on Subway Relief

Commission Engineer Holds Lengthening of Local Platform Easiest to Increase Subway Capacity

An extended hearing was given to the subject of the lengthening of the platforms of local stations by the Interborough Rapid Transit Company on March 16 by the New York Transit Commission. In general, opinion seemed to favor the plan from the transportation standpoint as the quickest and easiest way of increasing the subway capacity, though the company declared that it should not be obliged to pay the expense of this lengthening.

Daniel L. Turner, consulting engineer of the commission, specified that the present platforms at the local stations were of various lengths, but that 81 platforms would have to be extended at 48 stations, aggregating 2.2 miles, to permit operation of ten-car local trains. This would add about 380 additional cars during the rush hours and would increase the capacity of the subway from 25 to 33 per cent. His observations indicated that in making a trip two-thirds of the passengers use at least two trains, one express and one local, and that one-third of the passengers use three trains, one express and two locals. The cost of reconstruction of the platforms was estimated by him at $12,000,000, and the cost of the 382 additional cars, of which 70 per cent would be motor cars and 30 per cent trail cars, would be $10,425,000. Additional power and other equipment would add $6,196 000, thus making a total of $28,621,000.

President Hedley for the company admitted the change would increase the capacity of the subway, but pointed out that the proposed plan would unbalance the relation between local and express traffic, which, with ten-car express trains, would call for about eight cars on locals. A ten-car train is about the limit for normal operation. The possibility of adding one or more cars to the local trains, properly marking them and opening them up only at the express stops, was also considered.

Chairman McAneny outlined the possibility of the city advancing all of the funds required to make the platform extensions. While under the present contracts the company is required to pay half of the construction cost of additions and betterments that are just and reasonable, this proposed payment would be entirely for city property, the city could finance the borrowing for considerably less than it would be possible for the company to do, and as the city would have to reimburse the company eventually for this expenditure, it would be the gainer by doing the work itself. Further discussion was postponed until a later hearing.

COMPANY WILL CONTEST

At a hearing by the commission on March 19, the company, through its counsel, Mr. Quackenbush, declared it would contest in the courts any attempt to assess on it a part of the cost of extending the platforms, on the ground that these lengthenings were not in the contemplation of the parties to contract No. 3 when it was signed, nor at the time of its readjustment in 1918, nor when the whole matter was again under consideration in 1922. He further stated that the company could raise these large funds now, if at all, only under such conditions as to make the attempt improvident.

Official Comment at Chicago

Heads of Railways Enlighten Stockholders on the Proposed Purchase by the City

Two of the annual reports just issued by the railways at Chicago have brought expressions regarding the Chicago city program from three of the leading transportation men of the city. One came from Henry A. Blair, president of the Chicago Surface Lines and of the Chicago Railways. It is Mr. Blair's only personally penned viewpoint on the city plan. He said in part:

> While fully satisfied of the sincerity of the Mayor's efforts to work out a plan which will deal fairly with all concerned and which will attract to local transportation properties the large amount of new money essential to enlargements commensurate with the city's growth, nevertheless the undersigned has not been able to concur in the view that the proposed certificates can be rendered thus attractive to new investors. Accordingly, as an alternative in case it should be found that the proposed certificates are not marketable the undersigned has submitted for the consideration of the local transportation committee of the City Council a plan whereby the necessary additional money would be obtainable and whereby the enlarged system would be operated at cost (including a fair return to capital) under franchise which the city might terminate at any time upon paying to the investors the amount of their investment.
>
> The Mayor's plan contemplates enlargements and extensions which will require the expenditure of several hundred million dollars in addition to making provision for the investment in existing transportation properties, so that the question of the marketability of the proposed certificates is fundamental to such plan.

Mr. Blair comments on the fact that the security holders of the Chicago Railways are already engaged in complicated law suits over their respective right to dividends and to participate in the election of directors. The significance of this lies in the fact that there is no provision on the city's plan to pay anything at all to some of the security holders and a part of the litigants are among these.

He says:

> It is regrettable that the litigation should have been interjected into a situation so complicated and critical as that presented by the expiration of the present franchises and the maturity of all the company's bonds on Feb. 1, 1927; especially in view of the well-known fact that any plan—no matter by whom proposed—which contemplates sale, lease, consolidation or merger of the company's properties cannot be consummated, under the participation certificate agreement "unless and until the holders of a majority in amount of the total number of the equal parts represented by all of the four series of participation certificates shall consent thereto" in the manner provided in the agreement of Aug. 1, 1907, under which the four series of participation certificates were issued.

Mr. Blair had already approved much of the physical plan of the proposed consolidated system and declared that the co-ordination it proposed was an economic necessity.

Similar approval is given the physical plan by Leonard A. Busby, president of the Chicago City Railway, who devotes nearly 2,000 words in his annual report to a description of the ordinance. His analysis coincides with that given editorially by the ELECTRIC RAILWAY JOURNAL of March 7. He says:

> The proposed ordinance is often referred to as a municipal ownership and operation proposition. In substance it is neither municipal ownership nor operation. As a matter of fact the city will not contribute a single dollar toward the purchase of these properties. While the legal titles will be vested in the city, the beneficial ownership of the properties will rest in the holders of the public utilities certificates until these are paid, either through earnings of the properties or funds provided by the city.

Samuel Insull, head of the Chicago Rapid Transit Company, the elevated lines, warmly indorsed the project in his annual report, not, he explained, that he abates his mistrust of municipal ownership and operation a whit but because it is the closest approach yet made to offer the city an ideal transportation system. He said he would accept the "Schwartz certificates" which the city will offer in payment.

Toledo Board Wants Action

Prompt action of some kind on a plan to give Toledo, Ohio, better railway service and enable a fare reduction is expected as a result of the dispatch of a letter to the City Council on March 16 by the street railway board of control. The board expresses the belief that "after four years of operation of this franchise ordinance Toledo is not served by adequate, comprehensive and unified means of service." In conclusion the board says:

> We therefore respectfully recommend that you promptly give thorough consideration to a comprehensive study of the transportation problem and that you promptly invite from the Community Traction Company a proposal for remedying the transportation situation:
>
> 1. As to the immediate improvement of service.
> 2. As to the discharge of accrued financial obligations to the city.
> 3. As to the prompt repair of pavements and the rebuilding of defective tracks and for the providing of a crosstown service and such improvements to and extensions of the system as shall adequately serve the community's needs.
> 4. As to the immediate lowering of the rate of fare.
>
> We respectfully urge prompt consideration of this matter by your honorable body.

Back of the action the City Council holds in its hands the home-rule power over buses and has before it two or three plans for city-wide systems which would compete directly with the traction lines.

Officials of the Community Traction Company have already laid before the Council a plan to reduce expenses by the elimination of bus competition, make further use of one-man cars, adopt the skip-stop and carry out other minor economy features.

Bill to Abolish Utah Utilities Commission Killed

A bill providing for the repeal of the state law creating the Public Utilities Commission of Utah was recently killed by unanimous vote of the members of the House at the legislative session now being held in that State. The measure was known as House Bill No. 32. It was referred to the committee on public utilities and reported out of that committee with the recommendation that the enacting clause be stricken. On motion this report was unanimously adopted.

Buses in Cleveland by June 15

Buses will probably be operated in Cleveland, Ohio, by the Cleveland Railway, starting about the middle of June, now that Gov. A. Victor Donahey has signed the Collister-Krueger bill giving municipalities control over their local transportation. This bill becomes a law on June 15. It was designed to permit the Cleveland Railway to operate buses. In addition to giving home rule to municipalities in motor bus transportation, the new measure also provides for local control by "contiguous municipalities."

John J. Stanley, president of the Cleveland Railway, has announced that plans of the company call for operation of buses over fourteen routes in the city of Cleveland, and that to carry out this plan between 80 and 90 buses will be required. Sixty per cent of these buses will be single-deck vehicles designed to be used as feeders to the railway system. The other buses will be double-deck. They will be used over two routes, paralleling main lines of the railway. One of these routes will be along Clifton Boulevard through Edgewater Park, from the Public Square to Rocky River, paralleling the Clifton Boulevard line, and the other will be along Prospect and Carnegie Avenues from the Public Square to the Heights section. Railway officials say that if the bus line paralleling the Clifton Boulevard line is as successful as they anticipate, no street cars may be operated during the non-rush hours over the Clifton Boulevard line.

The problem of financing the investment in buses is still bothering the railway officials, inasmuch as the service-at-cost grant in Cleveland provides that no new stock may be issued except at par. The present market quotation of the railway stock is around 92. Councilman Sanders, former city street railway commissioner, has suggested that the company be permitted a special allowance of 3 cents a car-mile for the purpose of buying buses. This idea has met with favor in railway circles. If this is done, the amount expended for buses in Cleveland would not become a capital investment. Councilman Peter Witt, also a former street railway commissioner, has suggested that the city issue $250,000 in bonds, buy the buses itself and lease them to the railway.

Franchise Negotiations at Oakland Unproductive

Inability of the city of Oakland, Cal., and the Key System Transit Company to agree on terms has made it impossible for the proposed new franchise to be voted on at the spring election. The company some time ago made a request for an indeterminate franchise. Leon Gray, City Attorney, in behalf of the municipality offered a 50-year franchise. President C. O. G. Miller of the railways stated that only under an indeterminate franchise can the interests of investors be properly protected.

Mayor John L. Davie and Commissioner Frank Colbourn oppose the 50-year franchise. The Mayor says it is "too long a time." Commissioner Colbourn advised the City Council to "go slow in granting 50-year franchises."

In rejecting the terms of the 50-year franchise Mr. Miller said substantially:

> While we are prepared to join in his earnest effort to simplify and make possible the adoption of charter amendments which will protect the public interest and permit the owners of the present franchises to surrender their franchises for resettlement franchises, there are some provisions in the proposed amendments which, if not modified, will make it impossible for us to do so.
>
> We owe the public the best possible service, but in order to discharge that duty it is essential to the security of the investors that they be protected by franchises containing proper franchise provisions. The franchise situation of the company is bad, but not desperate. Some of our present franchises have only a short time to run, but they are reasonably workable in their present shape. Others are too short in their terms to permit permanent refinancing. The engineers now making a survey of the traffic needs of Oakland have intimated that it will not be possible for them to accomplish their purpose without new franchises for additional lines; that such franchises cannot be provided under existing charter provisions, and that the charter must be amended. The company desires such provisions so it can comply with the purpose of the survey. It will be readily appreciated, however, that this company cannot surrender its existing franchises and accept new franchises so burdened with restrictions and unreasonable obligations as to impair its usefulness to the public. To adopt such amendments would not better the situation but would delay the possibility of carrying out the recommendations of the board of engineers.

As a substitute for the 50-year franchise the company has submitted its own proposal to the effect that the City Council shall grant indeterminate franchises to expire only when the city is ready to take over the railway and "pay a reasonable price" for it.

Articulated Service Is Begun in Atlanta

Buses were placed in service on Sunday morning, March 8, by the Georgia Railway & Power Company through the Ansley Park and Morningside Drive section and also the Sylvan Hills section, in accordance with requirements recently imposed by the Mayor and General Council. This service is to be continued until the permanent coach service can be established through this and other territory asked on behalf of a corporation to be owned by the Georgia Railway & Power Company.

For this temporary bus service the company is using the buses formerly owned by the Crosstown Express and operated through this territory. The company explains that they are not to be taken as indicative of the type of coach which the company will use on its permanent coach routes. The company will make a thorough investigation of coaches and select modern coaches of the most approved and attractive type for this service. The necessity for starting the bus lines immediately compelled the use of the buses at hand.

The fare for a ride on the buses for any distance or for any ride on the combination use of these buses and the railway system of Atlanta will be 10 cents per person per ride. A passenger boarding one of the buses on an inbound trip will pay 10 cents. Passengers desiring to transfer to the railway system will, upon request being made at the time of the payment of the fare, be issued a bus-street railway exchange ticket, which, upon presentation on the first connecting railway car at the point of transfer or exchange, will insure the same rights as the railway fare.

A temporary order, preventing enforcement of the city ordinance designed to end jitney operation in Atlanta, was granted in Superior Court on March 6 by Judge George L. Bell upon petition of bus owners and operators of 110 cars. The ordinance to abolish the jitneys was designed to be effective at midnight on March 8.

The petition asked the court to declare the ordinance null and void on the ground that it was unreasonable and discriminatory and that it violated the state and federal Constitutions. It termed the anti-jitney ordinance a "legislative and propaganda scheme to put the jitney out of business, not a law to regulate but to prohibit." It added:

> The ordinance is a result of a political and propaganda campaign of the Georgia Railway & Power Company to stifle competition; but now the company has gone into the jitney business itself, obtaining under this ordinance a monopoly.

Argument on the matter was begun before the court on March 14, but the presentation of the case was not completed that day and adjournment was taken until March 16.

Breaking Ground for New York's New Subway

Mayor Hylan broke ground on March 14 for two sections of the city's new subway system. The ceremonies were held in the public square at Hancock Park, 123d Street and St. Nicholas Avenue. The Mayor's speech was sent out by radio from the municipal broadcasting station.

Following the speechmaking, the Mayor, with a silver pick and spade, broke ground in Hancock Park, under which the new line will be built. This part of the line, known as Route No. 78, Section 3-A, extends under St. Nicholas Avenue from 122d to 133d Street. The contractor is the Rosoff Engineering Company.

The other section for which ground was broken immediately following the Hancock Park ceremonies is Route No. 78, Section No. 3, extending from Eighth Avenue and 111th Street to St. Nicholas Avenue and 122d Street.

The value of the two contracts in the aggregate is $9,500,000.

The city's new subway system extends from 193d Street and Fort Washington Avenue, down Fort Washington Avenue to 173d Street to Broadway to St. Nicholas Avenue to 122d Street to 8th Avenue into Central Park West, skirting Columbus Circle, down Eighth Avenue to 53d Street, where a branch will turn east through 53d Street under the East River to the Union Station in Queens.

From 53d Street another leg of the line will go down Sixth Avenue running parallel with the Eighth Avenue line. The Sixth and the Eighth Avenue lines will converge at Greenwich Avenue and Eighth Street, thence down the Sixth Avenue extension to Canal Street, thence down Church Street to either Fulton or Wall Street, thence under the East River to Brooklyn.

From the Union Station in Queens a branch will extend to Jamaica and another branch will go through Long Island City, Greenpoint, Williamsburg and into central Brooklyn and downtown to meet the tunnel from the lower end of Manhattan, thus making one complete circuitous route connecting Manhattan, Queens and Brooklyn.

The Manhattan routes of the city's new system were adopted by the Board of Estimate last December. The Central Park West-Washington Heights sections of the west side line have already been validated and approved.

It is explained that the routes and general plan for the Manhattan portions of the new subway system are presented first for the reason that the physical difficulties of subway rapid transit construction are greatest in Manhattan and because all lines from other boroughs will pass through the new Manhattan trunk lines.

Another Operator Hides Behind Interstate Commerce Provision

Harrison B. Freeman, receiver of the Hartford & Springfield Street Railway, Warehouse Point, Conn., has filed a damage suit for $5,000 against the Interstate Bus Corporation. The bill alleges illegal competition.

Mr. Freeman stated that a company made up of bondholders of the railway invested $50,000 in buses for the transportation of passengers between Hartford, Conn., and Springfield, Mass., under franchises and the statutes regulating motor vehicles. He complains that the Interstate company started operating buses over the same line on Jan. 21, 1925, without license or registration.

The Interstate company contends that it is not subject to the control of state bodies, but to the Interstate Commerce Commission on the grounds that it is doing an interstate business.

Agreement Up in Rochester

A draft of the proposed agreement between the Amalgamated employees of the Rochester lines of the New York State Railways and the company was to be submitted to the membership in Rochester at a meeting on March 20. The provisions of the pact have not been revealed, but a demand for one day of rest in seven is assured and a plea for an advance over the present 55 cents an hour rate has been intimated. The present contract with the railways will expire on May 1. The Rochester union acts in conjunction with the employees in Utica and Syracuse and on the interurban lines.

Service-at-Cost Measure in Missouri

A bill authorizing cities of more than 100,000 population to adopt a "service-at-cost" plan has been introduced in the Legislature of Missouri at the request of counsel for the reorganization committee of the Kansas City Railways. The bill merely is an enabling act to permit Kansas City and St. Louis to adopt the plan in co-operation with the common carriers subject to approval of the State Public Service Commission.

She Stoops to Inspect

A housewife of East St. Louis, Ill., who has been seen on the cars of the East St. Louis & Suburban Railway so often during the past six weeks was not merely wasting her time by gadding about. She had a task to perform and she did it well, as twenty-four motormen and conductors of the railway will attest who have been commended for their personal appearance and the cleanliness of their cars and rewarded with prizes of $5 each and a day off with pay as recognition of their worthiness as reported by the housewife in question. The woman was acting as inspector general for the railway in its third annual clean-up campaign for cars and car crews. She surveyed necks and steps, collars and floors, fingernails and car seats. On the basis of her reports to W. H. Sawyer, president of the company, 46 men received the maximum reward, while more than 100 others received a $5 bonus.

First Weekly Pass in Maine —Bus Plans

The York Utilities Company, Kennebunk, Me., plans to use the weekly pass starting on March 29. The company proposes to sell the pass, good for bearer, in specified 10-cent zones at $1.25 for the first pass with a rebate of 25 cents if the pass is turned in when the next succeeding week's ticket is purchased. This will be the first installation of its kind in Maine.

Data on the company's activity in the bus field contained in the item published in the issue of the ELECTRIC RAILWAY JOURNAL for March 14 were incomplete and in at least one respect inaccurate. The company states that the new bus service will be given not only to Kennebunkport but will include the discontinued Cape Porpoise branch, so that no part of the territory served by the present line will go unserved. In addition, the new bus line and another new bus line will serve five additional towns. The York Utilities Company, which operates in Sanford, Kennebunk, Kennebunkport and Biddeford, is not in receiver's hands and never has been.

Rice Safety Award Won by Beaver Valley

The Beaver Valley Traction Company, New Brighton, Pa., was presented with the Cecil G. Rice safety award in Pittsburgh on March 2, at the annual safety banquet of the Western Pennsylvania Division of the National Safety Council. Some of the results follow, showing the decrease of various items last year with the average of the previous three years:

	Average of Years 1921–1922–1923	Year 1924	Decrease, Per Cent
Fatal accident	None	None	...
Permanent disability accidents	None	None	...
Accidents causing more than 10 days' disability	11	4	175
Total number of accidents	51	24	47
Total hours lost	5,051	1,568	233

These accidents are personal injury accidents among employees. The street car accidents are on the decrease, too, but with the inspiration of the Cecil G. Rice award the company says that the effort should be made to reduce further the accidents on the street and thereby add more glory as a result of individual efforts.

The Duquesne Light Company, the Pittsburgh Railways, and the Equitable Gas Company were among the ten companies showing the greatest decrease in personal injury accidents.

Intensive Merchandising Campaign by Kansas Road

Officers of the Union Traction Company, with lines from Nowata, Okla., through Coffeyville, Independence and Cherryvale to Parsons, Kan., are to fight fire with fire. If buses give travelers better service, so will the interurban. If trucks running on Montgomery County hard-surfaced roads offer better service to express and other shipments, so will the Union Traction. In line with the new policy the company is broadcasting the word of special care and speed for express with two deliveries daily to any town on the lines. Special facilities are offered the regular shipper in the way of accommodations.

In the passenger department, the inroads of the motor cars were ignored for years. Traffic fell off and the road cut the schedule from the original hourly one to an hour and a half. Later it was cut again.

Late in December came the resolution to offer service in competition with motor cars and hard roads. An order was placed for six new one-man modern type cars for the interurban lines. When they are put into service, possibly by April 1, the old schedule will be abandoned and cars returned to the hourly schedule.

The electric railway between Independence and Coffeyville was built and placed in service in 1907.

New Bus Proposals Called in New York

The Board of Estimate of New York City on March 13, following the recommendation of John H. Delaney, chairman of the Board of Transportation, voted to scrap the 80 applications filed by corporations and individuals for franchises to operate buses on the city streets. The board, at the same time, invited those who seek such privileges to submit new applications not later than April 9. In extending this invitation the board also submitted a questionnaire, prepared by Mr. Delaney, which it suggested all applicants for franchises should answer.

The 80 applicants whose initial proposals must be recast include those corporations and individuals who have submitted proposals to the Board of Transportation or the Board of Estimate since July 1 of last year. They were reviewed in a general way in the bus report filed last month by the Board of Transportation and in which Commissioner Delaney and his associates suggested a city-wide system of about fifty-eight routes. These were finally approved by the Board of Estimate.

23 Miles of Subway Routes Approved in New York

The Board of Transportation of New York City adopted additional subway routes on March 20 totaling 22.90 miles, the construction cost of which is estimated at $186,046,000. The routes are located in Manhattan, Brooklyn and Bronx, include subaqueous tunnels and are additions to the administration's independent subway construction program which was announced last December by John H. Delaney at a meeting of the Board of Estimate.

Approves Bus Operation Within City

The New York State Railways won another round in its battle for the right to operate buses over the Ridge Road from the suburban town of Greece into the city when the Rochester, N. Y., Common Council recently approved the petition of the Rochester Railways Coordinated Bus Lines, subsidiary of the New York State Railways, for operation within the city. The railway has received the requisite permission from the Town Board of Greece and its plea is pending before the board of Parma. If granted there, the matter will go to the State Service Commission. Buckley Brothers, as related previously in the ELECTRIC RAILWAY JOURNAL, now operate a bus line over the route covered by the traction company's petition. James J. Dadd, secretary of the New York State Auto Bus Association, has announced the intention of the independent owners to carry the fight to Albany in their efforts to prevent the railway winning a franchise.

In the previous reference in the JOURNAL to the bus activities of the New York State Railways it was made to appear that they were to extend to Schenectady. The stock of the Schenectady Railway is owned jointly by the Delaware & Hudson Company and the New York State Railways, the latter being controlled by the New York Central Railroad, but is separately operated. The Schenectady Railway is prepared to enter the bus field, but it will do so through a subsidiary under the direct control of that company.

News Notes

Will Fight Ouster Ruling.—Jitney owners of Huntsville, Ala., are preparing to protest the ruling of the Alabama Public Service Commission, which recently issued an order preventing them from operating between Huntsville and outlying mill suburbs in competition with the electric railway of the Alabama Power Company.

Interurban Passengers Pay Same Amount.—The Public Service Commission has approved new rates of the Rochester, Lockport & Buffalo Railroad for local passenger fares. Fares are so adjusted that interurban passengers will pay the same amount within the city of Lockport, N. Y., as would be charged for a local ride within the city limits. A new regulation provides that an excess fare of 10 cents will be charged on all cash fares over 16 cents. When excess fare is charged the cash fare receipt issued by the conductor will so indicate and such excess fare will be refunded upon presentation of receipt, within 90 days from date of issue, to any authorized ticket agent or at the office of the treasurer.

Employees Inspect Shops.—About 100 employees of the rolling stock and shops department of the Boston Elevated Railway, Boston, Mass., divided in groups of four, recently were taken on an inspection trip to the Albany Street shops of the company. They were escorted by a guide through the drafting room, truck and wheel shop, brass foundry, armature shop, compressor room and other shops. They were met by the respective foremen, who explained the methods used in overhauling and repair work and described the uses of the various machines and equipment. Exhibits were placed throughout the shops for inspection and attracted much attention.

Will Confer on Fare Reduction.—Representatives of the City Council of Glendale, Cal., the Chamber of Commerce and the Pacific Electric Railway will confer with the State Railroad Commission in an effort to find a basis for reducing fares between Glendale and Los Angeles. This decision was reached at a recent special meeting of the Council. If possible, a ninety-day or six-month trial will be given the 10-cent flat rate plan, to see if it will earn a sufficient revenue for the company to warrant adoption as a permanent rate. At present the one-way rate between Glendale and Los Angeles is 23 cents, while 38 cents is charged for a round trip. The rate between Los Angeles and Hollywood is 10 cents each way.

Developing the Service Instinct.—Another company pamphlet made its première on March 16 under the title of "Service." This single sheet, published by the United Railways & Electric Company, Baltimore, Md., is "to encourage helpfulness and co-operation in transportation." The first edition promised that "service" would be the theme of every paragraph and sentence. It gave inclusive and enlightening answers to the question "What is service in Baltimore with street cars and buses?"

Increased Fare or Tax Reduction Needed.—Either the fare must be increased or the taxes assessed against the United Railways, St. Louis, Mo., reduced if the company is to be operated as a going concern, Rolla Wells, receiver for the system, asserts in the current issue of the "United Railways Bulletin," the company's official publication. The gross revenues for the company in 1924 showed a decrease of $1,003,000 compared with 1923, while for the first two months of this year operating income showed a decided falling off compared with the first two months of 1924. Receiver Wells concludes that the car riders will have to make up this deficit by paying higher fares or by interesting themselves in seeing that the tax burden of the company is lightened. In addition to paying high taxes the company is also compelled to meet competition from buses, private automobiles and service cars.

Foreign News

Ventilation in Paris Subways to Be Improved.—Complaints of impure air in the subways of Paris, France, have become so numerous and pressing that the Prefect of the Seine has ordered measures taken at once to improve conditions. Disinfection methods have been proposed, but it has been decided that better ventilation and not disinfection is what is needed. The installation of motor-driven fans at four different points is expected to give the desired improvement in ventilation on the Metropolitan system.

Tramways Profit, Buses Lose, in Hull.—An actual net profit of £27,500 will be shown on the tramways operation of the Hull Corporation Tramways, Hull, England, at the end of the financial year, March 31, 1925, according to the report presented before the Hull Corporation tramways committee late in January. This estimate takes into account the loss on bus operation, which is estimated at £5,475. The city engineer was given a contract for reconstruction of part of the Heddon Road track at a cost of £20,951, and his estimate for work on the Holderness Road track was also accepted.

Reports on Electrification in Belgium.—The commission appointed some time ago to inquire into and report on the practicability of electrifying the railroad between Matadi and Leo, in the Belgian Congo, has now presented its report, which is entirely in favor of the project. It is recommended, however, that a commencement should be made with the first 60 miles of the line, between Matadi and Sognololo, which has the most severe grades on the system.

Brazilian Electric Railway Proposed.—A project for the construction of an electric railway from Caracol to Espirito Santo do Puihal, in the State of Minas Geraes, Brazil, is under way.

New Cars for Manchester.—The Manchester Corporation Tramways, Manchester, England, expects to put 70 new vestibule bogie tramcars into service during the first half of 1925. The electrical equipment will be furnished by the British Thomson-Houston Company. The ordinary output of about 25 cars a year from the Town Council's own works will be continued. This additional equipment is required to handle increased traffic. The tramway was extended 8½ miles in 1924, and another 8 miles is soon to be put in operation.

Pre-War Fares in Sunderland.—The Sunderland tramways committee, Sunderland, England, has decided to return to pre-war fares. The 1½d. fare is reduced to 1d., and ½d. is taken off all the higher fares. It is estimated that on the basis of the present traffic this will mean a reduction in revenue of more than £20,000 a year.

Barcelona Subway to be Built.—Three miles of the track of the Sarria electric railroad, leading to the terminal in Barcelona, is to be made into a subway.

Financial and Corporate

Comment on D. U. R. Situation

Politics and Absent Ownership Held Responsible for Receivership—Bus Had Rather Late Start

Bankers in intimate touch with the finances of the Detroit United Railway, Detroit, Mich., believe that with proper capital changes the road cannot help but work out its difficulties. This is the opinion expressed by the Detroit correspondent of the *Wall Street Journal* in a special dispatch in the issue of that paper for March 16. This writer says the receivership of Detroit United is the result of adding quickly changing transportation conditions to an already incongruous mixture of politics and absentee ownership. He says the statement sent to stockholders is subject to criticism in one respect; instead of slack Detroit business being responsible for the Detroit United Railway receivership, the trouble is due more to the road's inability quickly to avail itself of the kind of facilities now in demand.

SLOW START ON THE NEW PROGRAM

The author of the article proceeds to explain:

About a year ago the Detroit United began to buy up bus lines and also to install its own buses parallel to its electric lines where riders showed a preference for motor transportation. Commendable work has been done toward building up a system of motor lines both feeding and supplementing the electrics. But it was a late start. Few large American cities depend so largely on individual motor transportation as Detroit. Where 10 years ago the city expanded along the interurban lines and provided electric traffic, the bus and private automobile have made it possible to develop suburban real estate which has no rail service of any kind.

It is further pointed out that since the sale of the city lines to the city of Detroit two years ago the Detroit United, except for a limited amount of freight, has been strictly an interurban and commuters' service. There has been no big city line earning bulk to cushion against.

Whether or not the analysis of the financial writer is correct, the opinions expressed represent the point of view of a man who is generally well informed. He says the receivership is viewed in banking circles as serving a good end in that it will permit a rearrangement of finances and probably new capital acquisitions which will insure carrying out the bus program, the possibilities of which, in an area of 100 square miles having about 1,300,000 population without steam commuter service of any kind, are hardly sounded. On this matter of commuter service the article says:

There is not a single commuter train out of Detroit on any steam railroad. Even the Michigan Central, with an unused downtown train shed and a string of logical commuter towns toward Ann Arbor, has done nothing to develop suburban business and refuses to install commuter service or give commuter rates.

Many Problems Before London Underground

Traffic Being Lost to Buses—Competition Hurtful—Lord Ashfield Says It Is Absurd to Build Underground Lines and Operate Them at Half Load with Traffic Diverted to Surface Transport

THE gross traffic receipts of the so-called Underground Group, London, England, which comprises the Metropolitan District Railway, the London Electric Railway, the City & South London Railway, the Central London Railway and the London General Omnibus Company, Ltd., for 1924 amount to £12,770,000, an increase of £650,000, or 5 per cent. This percentage increase falls short of the percentage increase in the number of passengers, because the average receipt per passenger in 1924 is slightly less than it was in the previous year, the reduction occurring wholly on the omnibuses. This is due to the bad weather of the summer week-ends. Between April 1 and Oct. 30, out of 30 week-ends not more than a dozen enjoyed sunny, cheerful weather, and the long-distance pleasure traffic was curtailed in consequence. It is also due in small part to minor adjustments in the fares charged.

The aggregate operating expenses are £10,820,000, and these are increased by £897,000 over the previous year. As a result the net receipts are £247,000 less than they were a year ago. Lord Ashfield, chairman of the companies, ascribes this to be the starting point of the unfortunate record of the year.

In order to carry the traffic 196,000,000 of miles were worked, an increase of 20,000,000 over the preceding year, or 11 per cent. Of these miles 137,000,000 were worked by the omnibuses, an increase of 18,500,000, or 16 per cent over the previous year. The remaining 59,000,000 were worked by the cars of the railways, an increase of 1,500,000, mainly required for the service of the newly opened Edgware extension. Thus while traffic receipts increased by 5 per cent the work performed to carry the traffic increased by 11 per cent.

The total number of passengers carried averaged almost 4,500,000 daily, and amounted for the year to 1,457,000,

COMPARATIVE STATEMENT OF THE OPERATING RESULTS OF THE LONDON UNDERGROUND GROUP YEAR 1924, COMPARED WITH 1923

	Total Railways		London General Omnibus Company Limited		Total	
	1924 £	Increase + £	1924 £	Increase + £	1924 £	Increase + £
Traffic receipts, etc., after the operation of the common fund under the terms of the London Electric Railway Companies' facilities act agreement, dated Dec. 21, 1915, and supplemental agreement, dated Dec. 8, 1921	4,371,636	*93,069*	8,398,565	+743,152	12,770,201	+650,083
Expenditure	2,766,368	*10,436*	8,053,315	+907,733	10,819,683	+897,297
Net receipts	1,605,268	*82,633*	345,250	*164,581*	1,950,518	*247,214*
Miscellaneous receipts (net)	484,845	*13,391*	315,206	+19,529	800,051	+6,138
Net income	2,090,113	*96,024*	660,456	*145,052*	2,750,569	*241,076*
Interest, rentals and other fixed charges	950,843	+183,169	205,525	+25,513	1,156,368	+208,682
Balance	1,139,270	*279,193*	454,931	*170,565*	1,594,201	*449,758*
Appropriation to reserve for contingencies and renewals	155,000	*60,000*	250,000	*125,000*	405,000	*185,000*
Balance	984,270	*219,193*	204,931	45,565	1,189,201	*264,758*
Appropriation for equalizing the charge in respect of interest on the 4½ per cent redeemable second debenture stock	.....	*82,500*	.....	.....	.....	*82,500*
Balance	984,270	*136,793*	204,931	*45,565*	1,189,201	*182,258*
Dividends on guaranteed and preference stocks	389,477	.....	.....	.....	389,477	.....
Balance	594,793	*136,693*	204,931	*45,565*	799,724	*182,258*
Add balance from last year's accounts	319,137	+65,944	64,641	*7,121*	383,778	+58,823
Total amount available for dividends on ordinary stocks and shares and for other purposes	913,930	*70,749*	269,572	*52,686*	1,183,502	*123,435*
Dividends on ordinary stocks and shares	665,542	.....	209,070	*48,547*	874,612	48,547
Rate per cent per annum	3.90	.....	6 (Free of Tax)	*3* (Free of Tax)	4.43	*.37*
Balance carried forward to next year's accounts	248,388	*70,749*	60,502	*4,139*	308,890	*74,888*

Figures in *italics* denote decrease.

MISCELLANEOUS STATISTICS OF LONDON UNDERGROUND GROUP YEAR 1924, COMPARED WITH 1923

	Total Railways		London General Omnibus Company Limited		Total	
	1924	Increase +	1924	Increase +	1924	Increase +
Passengers carried:						
Ordinary	205,881,127	*774,418*	1,158,411,377	+118,475,655	1,364,292,504	+117,701,237
Workmen	45,479,306	*3,045,565*	.....	.....	45,479,306	*3,045,565*
Seasons	46,995,650	*3,365,750*	.....	.....	46,995,650	*3,365,750*
Total	298,356,083	*7,185,733*	1,158,411,377	+118,475,655	1,456,767,460	+111,289,922
Average daily number of passengers carried	886,740	*20,899*	3,510,338	+ 433,605	4,397,078	+ 412,706
	M. Ch.	M. Ch.	M. Ch.	M. Ch.	M. Ch.	M. Ch.
Route-miles owned or leased	71 64	+ 4 14	....	....	71 64	+ 4 14
Route-miles run over by companies' trains	139 59.5	+ 24 64	....	....	139 59.5	+ 24 64
Road-miles run over by company's omnibuses	... .	....	778 0	+ 25 0	778 0	+ 25 0
Number of stations or garages	120	+ 3	40	+ 5	160	+ 8
Number of lifts	192	*31*	....	....	192	*31*
Number of escalators	32	+11	....	....	32	+ 11
Number of car-miles run in relation to passenger receipts	58,896,079	+1,518,425	137,050,535	+ 18,556,809	195,946,614	+ 20,075,234
Number of car-miles run by companies' trains or omnibuses	70,496,856	+1,820,986	137,050,535	+ 18,556,809	207,547,391	+ 20,377,795
Number of cars or omnibuses owned	1,561	+ 206	4,115	+ 246	5,676	+ 452

Figures in *italics* denote decrease.

an increase over the previous year of 111,000,000, or 8 per cent, and an increase of 285,000,000, or 24 per cent, over the year 1920, which represented the highest point in the artificial post-war prosperity. Never before has this group of companies carried so many passengers. The whole of the increase in the traffic has fallen to the share of the buses, with the result that more than 7,000,000 further passengers gained by the omnibuses have been lost to the railways. Lord Ashfield explains, however, that despite the loss by the railways it has not enabled any reduction in train service to be effected or any other economies to be made. As he has put it, the loss falls wholly upon the net receipts, and reduces the balance available for distribution in dividend upon the capital. What the buses have gained has been more than offset by the expense incidental to working a larger fleet of buses, so that here again the net receipts are less. For these reasons the common fund, after meeting all the calls properly made upon it, was £819,724, or £182,258 less than it was in the year 1923.

Competition Unfortunate

To Lord Ashfield it certainly is foolish to have provided underground railways to deal with congested traffic and then to permit them to be operated with half loads while other means of transport intervene to rob them of their traffic and retain it on the streets, not only restoring the congestion but making it more dangerous and tedious in the process.

Since Jan. 1, 1919, up to Dec. 31, 1924, the Underground group has spent on extensions and improvements, on new buses and garages, in one way or another £15,600,000, and is committed to a further expenditure of £5,350,000 to complete construction upon which the companies have already embarked. Until this expenditure becomes self-supporting by attracting additional traffic to the system as a whole Lord Ashfield says the management cannot possibly venture upon any fresh schemes of expenditures. The forward policy must, therefore, unless some change in the situation takes place, become a conservative policy. Although the management is being pressed to extend the Underground system and build new tube railways to all these projects it must turn a deaf ear. Not that many of them are not desirable and needful, but, as Lord Ashfield explains, "if London hopes to secure the execution of these projects, it can only be as part of a considered scheme of transport facilities, in which the various means of transport are co-ordinated, so that each takes only its proper share and in which the present unchecked and destructive competition is brought within reasonable and fitting limits."

As Lord Ashfield sees it the root of the company's present troubles is competition. There are 500 independent buses being run in London. The first of these buses appeared in 1922. At the close of 1922 there were 13; at the close of 1923 there were 194; at the close of 1924 there were 499. The owners consist of eight companies or groups of persons, owning from 44, the maximum, down to 12, the minimum number, and after that of numerous individual proprietors, of whom no fewer than 105 are the owners of one bus.

Lord Ashfield says that from the point of view of London traffic, and not alone from any selfish point of view, this incursion of individual omnibus proprietors should never have been permitted. As he sees it, it is a misfortune both to London and to the proprietors themselves that will require much tact and discrimination to clear up. One of the questions he suggests for answer is how a co-ordinated system of routes and services is to be secured out of a group of omnibuses owned by no less than 186 separate companies or persons. He was constrained to say:

> Does London want an orderly, efficient, economical system of transport? Then London must see to it that such measure of regulation and control is secured as will enable such a system to be maintained and developed.
>
> The London General Omnibus Company has entered into agreements with the associated tramways for the pooling of the traffic carried over the roads worked in common with them, and for the sharing of this traffic equitably between them in proportion to the services rendered. It was then possible for the tramways to look with less anxiety upon, say, the great development of routes to Wembley this last year, because they knew that out of the omnibus company's takings they might be able to claim some share if their own share were inadequate or unjust. The public needs were fully met, and the tramway company was not unfairly prejudiced. We have found, as those who are concerned with the administration of the London traffic act will find, that the only solution of this traffic problem is some means by which the warring separate interests may be resolved into a common interest, by which the many managements, with divergent aims, may be consolidated into a common management.

Lord Ashfield says he regards the London traffic act of 1924 to constitute the most important event of the past year and a landmark in the London traffic problem. All the talk and inquiry of a score of years is now focused in this act. The act itself provides little in the way of control, but it sets up machinery which can be used for control. This power rests in the Minister of Transport, acting largely under the advice of a committee composed of representatives of the various authorities in and adjacent to London, and of representatives of the police and central government. In conclusion Lord Ashfield said:

> The London traffic act of 1924 is, as I have said, a first step, but the first step is always the hard step. I fear the end of our troubles is not yet in sight, and many vexed questions must be resolved before we are in smooth waters, but I have confidence in those now intrusted with the responsibility for London traffic, and I feel sure that, given good will and breadth of view, good must come out of this act, for now that a start has been made we must march toward some goal, even though it is not exactly the goal at which I should aim myself.

New Holding Company Announces Financing

The National Electric Power Company, New York, is the new company formed to take over the control of the Cumberland County Power & Light Company, serving Portland, Me., and vicinity, and the Northwestern Public Service Company. It will own approximately 97½ per cent of the common stock of the Cumberland County company, which operates the Portland Railroad, and all the common stock of the Northwestern Public Service, which serves a wide area in South Dakota.

The Maine property was recently acquired by Albert Emanuel & Company, New York, who in the last year and a half have also acquired many small properties in the zone of the Northwestern Public Service Company.

In connection with the work of carrying out the details of the plan an issue of $3,750,000 of National Electric Power Company 20-year 6 per cent secured gold bonds was offered on March 16 by A. C. Allyn & Company. This is the first financing for the new holding company. It is to be followed, it was learned, by an offering shortly of $1,500,000 of 7 per cent cumulative preferred stock of the par value of $100 a share. In addition there is to be an issue of 10,000 shares of 7 per cent non-cumulative preferred, $100 par value, but this issue will not be publicly offered.

The properties now held by the

Emanuel interests in the area served by the Northwestern Public Service Company, including ten small companies taken over within the last several weeks, represent about 60 per cent of the total power generation facilities of South Dakota. They extend in a chain from Aberdeen, in the northern part of the State, to Yankton, in the extreme south, on the Missouri River.

The offering of the $1,500,000 of cumulative preferred shares of the National Electric Power Company will also be made by A. C. Allyn & Company.

Regular Dividend Declared at Boston

The usual quarterly dividend of 1½ per cent has been declared by the Boston Elevated Railway, Boston, Mass., payable on April 1 to stockholders of record of March 17. In the issue of the ELECTRIC RAILWAY JOURNAL for March 7, page 390, it was made to appear that the quarterly dividend had been reduced to 1¼ per cent. This was an error. The directors do not declare dividends at Boston. They are declared by the trustees, and Chapter 159 of the special acts of 1918 under which the trustees were appointed provides that the dividends on the common stock shall after 1922 be at the rate of 6 per cent per annum.

$933,277 Surplus for Market Street Railway, San Francisco

The gross revenue of the Market Street Railway, San Francisco, Cal., for the year ended Dec. 31, 1924, shows a small increase over the preceding year. For the first 6 months there was a substantial increase in gross, but this was partially offset by a decrease in the last 6 months, particularly during Presidential election.

Generally speaking, there were no important changes in service or in operating costs except some slight increases in maintenance charges and general expenses and in the item of expense for conducting transportation, due to a small increase in the rate of wages paid platform men and others effective May 1, 1923. In consequence the wages for the first 4 months of 1924 were approximately 5 per cent higher than for the corresponding months of 1923. On the other hand the slight increases in general expenses were partially offset by a decrease in the rate charged the company for electric power.

There is no deferred maintenance at the present time. In addition to the regular maintenance work, 28,000 ft. of single track was reconstructed and more than 300,000 square feet of asphalt and brick pavement was constructed or reconstructed in addition to the 450,000 square feet of paving which was laid in connection with ordinary repairs.

As soon as the subway along the Embarcadero at the foot of Market Street is open for traffic the company expects to effect material improvement in the service on lower Market Street, as practically all vehicular traffic along the Embarcadero will be diverted from the surface to this subway.

Notwithstanding the great increase in automobile traffic, there has been no material increase in the number of accidents or expenditures for claims. Accidents involving fatalities were fewer than ever before in the history of the company or its predecessor. The company attributes this to the training system for trainmen started several years ago, a development which it is expected will unquestionably continue to reduce both the labor turnover and the number of accidents.

On Dec. 31, 1924, the only outstanding funded debt of the company consisted of $13,000,000 of 7 per cent first mortgage bonds, of which $125,000 were reacquired during the year and placed in the sinking fund.

Charles N. Black, president of the company, says no material progress has been made in the negotiations for the purchase of the company's property by the city of San Francisco, although the committee has held several meetings and the matter is still under discussion.

STATEMENT OF INCOME AND PROFIT AND LOSS OF THE MARKET STREET RAILWAY, SAN FRANCISCO, FOR THE YEAR ENDED DEC. 31, 1924

Operating Revenue:		
Passenger	$9,789,153	
Other	63,075	
Total		$9,852,228
Operating expenses and taxes:		
Operating expenses:		
Maintenance of way and structures	$647,494	
Maintenance of equipment	660,126	
Power (including disputed charges)	1,335,344	
Transportation and traffic	3,587,298	
General and miscellaneous	808,523	
Total	$7,038,787	
Taxes (other than Federal income taxes)	617,000	
Total operating expenses and taxes		7,655,787
Net operating revenue		$2,196,441
Other income credits:		
Interest	$26,525	
Other	10,643	
Total		37,168
Gross income		$2,233,609
Income charges:		
Interest on funded debt	$857,508	
Discount on funded debt	42,656	
Provision for 1924 Federal income tax—Company's estimate	68,235	
Depreciation of railroads and properties	320,000	
Other	11,933	
Total		1,300,332
Net income for the year		$933,277
Surplus, Jan. 1, 1924		1,431,496
Profit and loss credits:		
Profit on purchase of company's securities	$2,320	
Profit on sale of other securities	33,510	
Other	1,230	
Total		37,062
Gross surplus		$2,401,836
Profit and loss charges:		
Refinancing expenses—net	$341,705	
Other	61	
Total	$341,766	
Surplus, Dec. 31, 1924		$2,060,070

OPERATING STATISTICS OF THE MARKET STREET RAILWAY FOR THE YEAR ENDED DEC. 31, 1924

Passengers carried:	
Cash fares 5 cents each	194,136,152
Special car passengers	15,200
School and other tickets, 2½ cents	3,195,844
Other tickets, 5 cents each	28,428
Total revenue passengers	197,375,624
Free transfer passengers	64,994,165
Total revenue and transfer passengers	262,369,789
Free passes	593,497
Total passengers	262,963,286
Percentage of transfer passengers to revenue passengers	30.37
Passenger revenue per revenue and transfer passenger, in cents	3.73
Car-hours	2,867,781
Car-miles	25,768,581
Miles of single track leased, etc	17.59
Miles of single track owned	256.21
Miles of single track operated	274.00
Number of passenger cars owned	768
PERCENTAGE OF OPERATING REVENUE	
Operating expense	71.42
Taxes (railway only)	6.26
Operating expense and taxes	77.68
Operating income	22.32
Non-operating income	0.37
Gross income	22.69
Deductions from income	8.76
Net income	13.93

$7,000,000 Montreal Issue Offered

A syndicate headed by Aldred & Company, New York, is offering $7,000,000 of the newly created Montreal Tramways general mortgage issue. The bonds bear interest at the rate of 5 per cent and, at the price of 88 and interest, at which they are offered, yield the investor 5.85 per cent. The bonds are secured by a general mortgage covering the entire property of the company and also other properties which may be acquired in the future. They mature on April 1, 1955.

The total authorized amount of the issue is $100,000,000, but for the present only $17,826,500 will be issued. This last amount is being used by the company to remove all of its perpetual debentures from the market and to replace them with the new bonds.

The new issue has one senior security—the first mortgage bonds, which are limited to an amount not exceeding $25,000,000. Of this issue $21,351,000 are issued. These bonds are due in 1941 and when these fall due the present issue will be a first charge on all the assets of the company.

Of the total present issue of $17,826,500, only $7,000,000 are being offered to the public, these representing the debentures held by Montreal Tramways & Power Company. The financing is being done in connection with the readjustment of the financial affairs of the company, referred to in the ELECTRIC RAILWAY JOURNAL for March 7, page 387.

New Holding Company for Southwest Utilities

The Electric Power & Light Corporation has been organized for the purpose of vesting in it the assets of the Utah Securities Corporation and certain equities in the other utilities which have been acquired by the Electric Bond & Share Company from time to time in the past. Included in the assets of the Utah Securities Corporation is all the common stock of the Utah Power & Light Company, as well as the common stocks and certain other securities owned by the Electric Bond & Share Company, New Orleans Public Service, Inc., the Dallas Power & Light Company, the Dallas Railway, the Texas Interurban Railway and the Power Securities Corporation, the latter company owning the common stock and certain other securities of the Idaho Power Company.

The companies to be included under the new arrangement furnish public

utility service in 253 communities, of which 245 are supplied with electric power and light service. Among the principal cities served are New Orleans, Dallas, Salt Lake City, Ogden, Durango and Montrose, Colo., and Boise, Pocatello and Idaho Falls, Idaho. The total population served is estimated at 1,179,000. More than 300,000 consumers are served and of these more than 234,500 are supplied with electric power and light.

Under this plan holders of Utah Securities Corporation capital stock will receive $10 per share in cash and four shares of the Electric Power & Light Corporation for each share of Utah Securities. A special meeting of Utah Securities stockholders has been called for April 2 to approve the plan.

Income Bond Payment Declared

Official announcement is made of the decision of the Quebec Power Company directors to pay the interest on the 5 per cent income bonds of the Quebec Railway, Light, Heat & Power Company, Quebec, Que. In commenting on this action the *Canadian Financial Post* says it means that the company has been whipped into such shape that in addition to earning the interest on the consolidated 5 per cent bonds it can show the income bond interest earned as well, and leave a creditable showing on the capital stock. Quebec Power owns 90 per cent of the income bonds, or about $3,000,000, par value. The starting of interest payments on these bonds will mean an income of more than $150,000 a year to Quebec Power. The opinion of the *Post* is that this would seem to assure to the common shareholders of the latter company an increase in the dividend rate this year.

Baltimore Railway Absorbs Competitor

The United Railways & Electric Company, Baltimore, Md., recently absorbed its largest bus competitor, the East Fayette Street bus line. This step is in accordance with the established policy of the company, which believes that the entire transportation system of the city should be under one management.

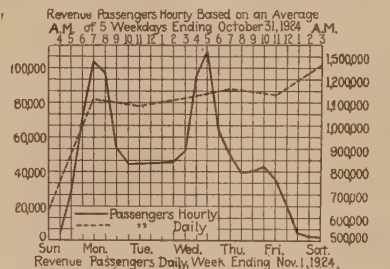
The East Fayette Street bus line operates 21 vehicles, each seating from 30 to 35 passengers, over a route also served throughout its length by the street cars. It is estimated that approximately 10,000 persons a day are being carried on a 5-minute base headway with 2½-minute service during the rush hours. The company came into existence in 1922, when several independent bus owners merged and bought a number of large, well-equipped, modern buses.

The United Railways & Electric Company will take over the buses at midnight on March 31. For the present it is planned to continue operation along the same route with the same schedules and at the present rate of fare. This is now 7 cents on the buses as against 7½ cents on the cars. The railway plans to have its accountants make an immediate study of the operation of the bus line to determine accurately its revenues and expenses.

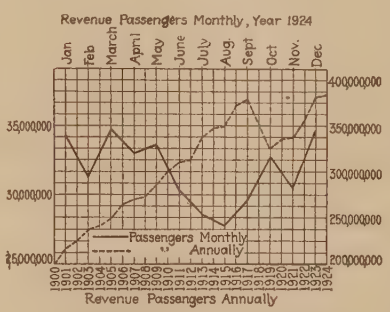
Impressive Presentation of Traffic Fluctuations at Boston

Traffic on the lines of the Boston Elevated Railway, Boston, Mass., varies from the normal base traffic of 45,106 revenue passengers per hour to 115,197 revenue passengers in the evening rush hour, an increase of 155.4 per cent, and then gradually falls off until it reaches its minimum in the early morning (night car) service, preparatory to again starting the upward climb to the morning rush hour peak.

During the days of the week there is a fluctuation no less significant. From Monday to Friday the daily traffic approximates an average of 1,109,861,


Revenue Passengers Hourly Based on an Average
A.M. of 5 Weekdays Ending October 31, 1924 A.M.
Passengers Hourly
" Daily
Sun Mon. Tue. Wed. Thu. Fri. Sat.
Revenue Passengers Daily, Week Ending Nov. 1, 1924.

Traffic Fluctuations by Day and Hour at Boston



Passenger Revenue Variations at Boston

rising to 1,216,132 on Saturdays and falling to 630,755 on Sundays, an increase over the normal of 9.57 per cent on Saturday and a decrease from the normal of 43.17 per cent on Sunday.

In the variations from month to month during the period of a year the swing is from August, the low point at 27,640,267 revenue passengers, to December and March, the high points at 34,366,600 revenue passengers, or an increase of 24.33 per cent.

Over a long period of years the curve starting in 1900 at 203,521,121 revenue passengers constantly increased to 1917 when it reached 381,017,338 revenue passengers, then passed through a period of recession, and again increased until 1924 when it reached a new high record of 382,888,848 revenue passengers.

Whereas the load from year to year over a long period is slowly on the upward trend, the great fluctuations are by the hour, day and week. These the company is explaining for the benefit of its employees are the factors which make operation difficult, are little known by the car riding public and are not generally appreciated by those actually engaged in the transportation service.

$8,975,000 Philadelphia Issue Offered

Public offering was made on March 14 by Dillon, Read & Company, New York, of a new issue of $8,975,000 of 6 per cent gold bonds of the Philadelphia Rapid Transit Company, Philadelphia, Pa., due March 1, 1962, at 99 and interest to yield more than 6.06 per cent. The sale will furnish proceeds for taking up short term securities totaling $6,750,000 and for other corporate purposes.

Figures made available in connection with the new offering showed that in 14 years under the management of Thomas E. Mitten and of W. C. Dunbar, now president, the company earned a surplus of $16,896,967, of which $11,244,385 was paid out in dividends and $5,652,582 has been put back into the property.

The new bonds are a direct obligation of the company and principal, sinking fund absorptions and interest payments are additionally secured by a direct mortgage on all the property of the Market Street Elevated Passenger Railway by the pledge of the entire outstanding capital stock and lease until the year 2000 of the Market Street Elevated and by guarantee through indorsement of the Union Traction Company of Philadelphia. Reproduction cost of the mortgage property is put at not less than $45,000,000. The company leases and operates 695 miles of track. Its new bonds are callable at 105.

Portland, Me., System Suffers Loss in 1924

The Portland Railroad, Portland, Me., earned during 1924 only about 40 per cent of the guaranteed 5 per cent dividend upon the railroad stock. The deficit for the year was approximately $60,000. This fact was disclosed in the annual report of the board of directors of the Cumberland County Power & Light Company, which controls the railway in Portland and South Portland. The report states that the continued increase in the use of automobiles leaves little prospect for an immediate improvement in railway conditions and intimates that a larger deficit for 1925 is to be expected. The Cumberland property promises to do everything possible to hold this deficit within bounds, but states it is confronted with a decreasing revenue without corre-

INCOME STATEMENT OF PORTLAND RAILROAD

For Years Ended Dec. 31

	1924	1923
Gross income	$1,582,264	$1,703,459
Operating expenses	1,294,781	1,396,808
Gross income less operating expenses and taxes	$287,483	$306,651
Deductions from income	247,598	247,598
Net income	$39,885	$59,053
Dividends	99,950	99,950
Deficit	*$60,065*	*$40,897*

Figures in italics denote deficit.

sponding decrease in expenses. The accompanying table shows the income account for the Portland Railroad for the years 1924 and 1923.

Willoughby Company Lowers Deficit

A comparison of operation for 1924 and 1923 of the Cleveland, Painesville & Eastern Railroad, Willoughby, Ohio, is shown in the accompanying statement. The company operates 39 miles of track. During the year 1924, according to the 29th annual report, total expenditures for additions and improvements chargeable to capital account were $30,964. The total amount of bonds outstanding on Dec. 31, 1924, was $1,631,000.

STATEMENT OF NET INCOME FOR YEARS ENDED DEC. 31, 1924 AND 1923, AND COMPARISON

	Year Ended Dec. 31 1924	Year Ended Dec. 31 1923
Total gross earnings	$546,743	$631,345
Total operating expenses	423,554	455,816
Taxes	38,772	49,094
Total	$462,326	$504,910
Net earnings	84,416	126,435
Interest and dividends	1,924	1,733
Gross income	$86,341	$128,168
Total income charges	$102,891	$156,242
Net income	$16,550†	$28,073†
Average miles in operation	33.91	33.91
Operating revenue per mile	$16,123	$18,618
Operating expenses and taxes per mile	13,633	14,889
Net earnings per mile	2,489	3,728
Net income per mile	488†	827†

†Deficit.

Increase in Philadelphia Dividend Made Effective

The Philadelphia Rapid Transit Company, Philadelphia, Pa., has declared a quarterly dividend at a rate placing the stock on an 8 per cent basis, as had been promised by the management, the increase of 2 per cent in the annual amount paid being on account of accumulated dividends under the 1907 contract wtih the city. The dividend is payable on April 30 to stock of record April 15.

Will Assume Debts.—In a supplemental order the California Railroad Commission has authorized the Sacramento Northern Railway specifically to assume the debts and outstanding obligations of the Sacramento Northern Railroad, which under prior order of the commission it was authorized to acquire. The order also allows the Sacramento Northern Railway to issue at not less than par $1,000,000 of common stock, and to assume the payment of outstanding bonds of the Sacramento Northern Railroad.

Manager for Receivers Appointed.—Minot J. Hill, general manager of the Trenton, Bristol & Philadelphia Street Railway, Bristol, Pa., has been named manager for the receivers of the Frankford, Tacony & Holmesburg Street Railway, Philadelphia.

Stone & Webster Year Book.—Stone & Webster, Inc., Boston, Mass., have issued the 1925 edition of the booklet in which they present data covering the operations of the properties with which they are identified.

Deficit in Napa.—A deficit of $7,878 was suffered by the San Francisco, Napa & Calistoga Railway, Napa, Cal., in 1924. The gross receipts were $279,416, operating expenses were $186,069, interest on funded debt $59,730, rents paid for leases of road $14,494, taxes $22,838, improvements $2,600 and miscellaneous deductions $1,563.

Seeks to Abandon Line.—The Wisconsin Public Service Corporation has applied to the Railroad Commission to abandon and tear up its tracks on its unprofitable Huron Street line in De Pere, Wis. The line is included in the city's new paving program, with the company's share of the cost estimated at $30,000, covering new rails, steel ties and pavement.

Seeks to Abandon Rather than Repave.—The Illinois Power & Light Company has petitioned the State Commerce Commission for permission to abandon service on the New Street line in Champaign, Ill. The street is to be repaved and, rather than face that assessment, the corporation will give up its tracks. It has proposed to the Council to operate buses over the route.

No Par Stock for Federal Light.—The directors of the Federal Light & Traction Company, New York, have voted to recommend to stockholders at a special meeting to be held April 28 that the common stock be split five shares for one of the present; also that the par value of the shares be changed from no par to $15, and that the par value of the preferred be reduced from $100 to no par.

Will Purchase Carhouse for City Use.—The City Council of Selma, Ala., recently adopted a resolution to purchase the carhouse of the Selma Electric Railway, which went out of business some months ago. The purchase price is $20,000, from which a deduction of $3,000 will be made for a piece of land which will be turned over to the railway. The city will use the building for a fire station and city stables.

Surplus Falls Off.—The gross earnings of the Lake Shore Electric Railway System, Cleveland, Ohio, for the year ended Dec. 31, 1924, were $2,780,953 compared with $2,774,481 for the year ended Dec. 31, 1923. Operation and taxes showed an increase, being $2,176,952 in 1923 and $2,268,642 in 1924. The surplus after the consideration of interest decreased from $172,461 for the year ended Dec. 31, 1923, to $92,199 for the year ended Dec. 31, 1924.

Merger Bill Passed by Senate.—The United States Senate has passed without debate the bill providing for a voluntary merger of the electric railways of the District of Columbia. This was accomplished by the adoption of an amendment, to meet the views of an objector to the terms of the measure as originally drawn, by which the approval of Congress will be necessary to effect consummation of any merger that may be arranged. The bill then went to the House, where, despite the congestion, it was said there was a chance of passage before adjournment on March 16.

Terminal Sold.—Negotiations have been concluded for the sale of the Auroro, Plainfield & Joliet Railroad's terminal at Van Buren and Joliet Streets, Joliet, Ill., to the Illinois Traction System for $47,500. Halsey, Stuart & Company, representing holders of the electric line's bonds, consented to the sale. The traction company has announced that it will remodel the building for its offices and use the structure as a bus line terminal. The traction system has also paid a paving assessment of $17,000 against the electric line.

Wants to Abandon Branch Line.—The Toledo, Fostoria & Findlay Railway will ask for permission to abandon its branch line between Bowling Green and Pemberville, Ohio, according to an announcement by officials of the company. City officials at Bowling Green asked about an improvement to be made along the line and the company immediately took action to give up the operation of that section, which has suffered greatly from competition of private automobiles. The city will not oppose abandonment of the line.

Receiver Appointed for South Bend Road.—Charles Currie has been appointed receiver of the Chicago, Lake Shore & South Bend Railway, Michigan City, Ind., by Judge Robert C. Baltzell in Federal court. His bond, set at $25,000, was provided. The petition for a receiver was filed several days ago by the Cleveland Trust Company, which sought to foreclose a mortgage on the property and equipment of the defendant. The company operates lines in and between Hammond, South Bend, East Chicago and Michigan City. The proposed plan for the reorganization of the property was outlined in the ELECTRIC RAILWAY JOURNAL, issue of Feb. 7, and subsequent events were referred to in the issue of March 7.

Authorized to Issue $2,141,000 in Notes.—The Department of Public Utilities has granted permission to the Boston Elevated Railway, Boston, Mass., to issue $2,141,000 of notes or bonds, payable in not more than 30 years, to bear a maximum interest of 6 per cent. Proceeds to the amount of $1,200,000 will be applied to the payment and cost of additions to the South Boston power station, $500,000 toward the repair shops at Everett, Mass., $200,000 will be used at the Forest Hills yards and shops and $241,000 will go toward miscellaneous construction work. The bonds are callable on any interest date at 105 after 10 years.

Wants to Abandon a Line in City.—The Jamestown Street Railway, Jamestown, N. Y., has petitioned the Public Service Commission for permission to abandon the Willard Street line in the city of Jamestown. A. N. Broadhead, president of the traction company, says the line has not paid operating expenses for some years. The company also has asked the State Utilities Board for permission to abandon the Chautauqua traction line between Mayville and Westfield. The company also is planning to remove the tracks of the Chautauqua Lake Railroad from Mayville to Chautauqua. The line has been under lease to the Pennsylvania Railroad, which has indicated its intention of giving up the lease.

Personal Items

Army Colonel to Help Build New York's Municipal Subways

Col. John R. Slattery, Corps of Engineers, U. S. A., has been appointed to the post of deputy chief engineer of the New York Transit Commission. Colonel Slattery will be the principal assistant to Chief Engineer Robert Ridgway in the advancement of New York City's new subway program.

Chairman Delaney of the commission wrote to Secretary Weeks of the War Department last February, requesting that leave of absence be granted Colonel Slattery, so that he might accept this position without forfeiting his army status and prerogatives between then and the date of his retirement next year. Colonel Slattery also made a personal appeal to the same effect. Secretary Weeks declined to grant their petition, explaining that it was contrary to good army policy to grant leaves of absence to army officers to permit them to enter upon municipal employ unless they were already eligible for retirement. Colonel Slattery then determined to resign his commission and accept the tender of the new post.

The new appointee has been in the service of his country since June 16, 1896, when he entered the United States Military Academy at West Point. He was graduated in 1900 and was assigned immediately to the Engineer Corps. During the World War he served in the A. E. F. as a Brigadier-General on the staff of Gen. John J. Pershing. In 1918 and 1919 he was attached to the Seventh Army Corps. Following his recovery from pneumonia in 1920, he served as army engineer in the Columbia River improvement below Vancouver. He has been particularly identified with subaqueous construction for the government. He is a native of Ohio and is reputed to be among the most expert of army engineers.

Ira E. Guthrie Resigns from Interstate Company

Ira E. Guthrie has resigned as secretary-treasurer and member of the board of directors of the Interstate Public Service Company, Indianapolis, Ind. Mr. Guthrie will leave soon after April 1 for Florida, where he will become associated in an official capacity with the Hollywood Land & Water Company, which is building the city of Hollywood-by-the-Sea, Fla.

Mr. Guthrie has been secretary and treasurer of the Interstate since shortly after its organization in 1912. At that time the only property of the company was 62 miles of electric railway between Indianapolis and Seymour. He has witnessed the company's growth until its resources are now in excess of $35,000,000. He was born near Columbus, Ind., and had most of his early business training and experience there. After teaching school for two years he was employed by industrial and banking interests in Columbus until 1903, when he became auditor of the Indianapolis, Columbus & Southern Traction Company, which built one of the first interurbans into Indianapolis. After it was extended to Seymour that road was leased to the Interstate in 1912 for a period of 999 years. Mr. Guthrie was prompted to leave Indiana in the belief that the change of residence to Florida would benefit his wife's health.

George R. Green General Superintendent at South Bend

George R. Green has been made general superintendent of the Chicago, South Bend & Northern Indiana Railway, Michigan City, Ind., and its affiliated lines, the Southern Michigan Railway and the Railway Transit Company, a bus-operating organization.

G. R. Green

This promotion is still another instance of a general superintendent drawn from the ranks of the mechanical forces. In Mr. Green's case it is literally from the ranks, for 24 years ago, at the age of 14, he started in the railway business as an armature winder's helper with the Detroit United Railway. He remained with that property for 18 years, except for three years between 1909 and 1912, during which time he was master mechanic of the Saginaw & Flint Railway.

Advancement was by small steps, but initiative, persistence and hard work, combined with an interest in the problems of his company outside his immediate duties, were bound to receive recognition. He finally rose to the position of general foreman of interurban equipment with the Detroit United.

In July, 1920, Mr. Green went to South Bend as superintendent of equipment. When it appeared that railway service might be supplemented with buses, he was selected to study bus operations in other cities. When the new service was decided upon he was placed in charge of starting and operating the buses. Next followed his appointment to be general superintendent of the rail lines and the buses.

George MacLeod Has Had Broad Career

George MacLeod is the new vice-president and general manager of the Buffalo & Erie Railway Company. The property is one of the new companies which grew out of the reorganization of the old Buffalo & Lake Erie Traction Company.

Mr. MacLeod's experience has been very broad. He has served in the steam railroad line, the electric railway field and has been prominently identified with bridge companies.

Following his graduation from Cornell University in the civil engineering class of 1890, Mr. MacLeod undertook the work of resident engineer of the Louisville & Nashville Railroad. Following this assignment he was superintendent for 7 years of the Kentucky-Indiana Bridge Company and Louisville, Kentucky & New Albany, Ind., belt lines. Later he was named receiver for the New Albany Street Railway, New Albany, Ind. In 1901 he relinquished the managership of the Kentucky & Indiana Bridge Company and the Louisville-New Albany Belt Lines to accept the post of general manager of the Lousville & Albany Railroad. Then in 1906 he became the chief engineer of the Kentucky Traction & Terminal Company, Lexington. Here he remained in a similar capacity until the fall of 1924, when he took on the duties of vice-president and general manager of the Buffalo & Erie Railway Company, with office in Fredonia, N. Y.

O. W. Brain and W. H. Myers, Australian Officials, Promoted

O. W. Brain was recently appointed assistant railway commissioner for the New South Wales Government Tramways, Sydney, Australia. W. H. Myers was appointed chief electrical engineer, succeeding Mr. Brain.

Mr. Brain joined the Crompton Electric Company following an early experience in England and Tasmania. He left that service in July, 1896, to enter the railway as chief assistant to the late P. B. Elwell. When Mr. Elwell was incapacitated through ill health, Mr. Bain was asked to take charge of the branch. This Mr. Brain did, and since Mr. Elwell's death in 1899 the organization in its present form has been built up under his administration.

W. H. Myers, his successor, who held the position of chief assistant electrical engineer of railways, was the first graduate of the Sydney University to obtain the degree of bachelor of electrical and mechanical engineering. Right after graduation he joined the engineering firm of Noyes Brothers in Melbourne, and remained with that firm until the end of 1904, when he received an appointment in the New South Wales Railway department to take charge, under Mr. Brain, of the electrical installations of the new railway station then under construction in Sydney. In 1906, he was appointed assistant electrical engineer and in 1911 chief assistant electrical engineer.

Charles F. Terrell was recently made general superintendent of light and power of the El Paso Electric Railway Company, El Paso, Tex. In this capacity he succeeds J. F. McLaughlin, transferred to Baton Rouge. Mr. Terrell has been with the Stone & Webster organization for the past 20 years and at Birmingham for the past two years.

Crawford Burris, formerly general foreman in the mechanical department of the Chicago, South Bend & Northern Indiana Railway, Michigan City, Ind., has been appointed master mechanic. Mr. Burris started with the company at South Bend in 1908 and has advanced step by step in the mechanical department since that time.

Robert E. Cornwell, purchasing agent of the Chicago, South Bend & Northern Indiana Railway and the Southern Michigan Railway, Michigan City, Ind., has been appointed assistant superintendent of equipment in addition to his present duties. This expansion in responsibility is due to the promotion of George R. Green to the position of general superintendent. In 1903 Mr. Cornwell started with the Indiana Railway as a city street car conductor, later advancing to timekeeper during construction of the Southern Michigan Railway. Following this he became ticket agent and then storekeeper. He held this last position for 14 years, and five years ago was again promoted, this time to become purchasing agent.

Obituary

James Nicoll Dick, chief engineer of power houses of the Montreal Tramways, Montreal, Que., died recently in Montreal. Mr. Dick had just completed a quarter century's service with the company. He was in his sixty-fifth year.

John J. Fahey, claim agent of the Scranton Railway, Scranton, Pa., died on Feb. 16. Mr. Fahey entered the employ of the Scranton Railway in 1906 as claim agent. In 1920 he was appointed chief claim agent, succeeding Stephen Dyer. Some time prior to his association with the company Mr. Fahey was sheriff of Lackawanna County.

Artemas Ward, pioneer in many forms of modern advertising, who introduced the subway and elevated newsstands and vending machines into New York, died recently. In the old days the news business was carried on almost entirely at the entrances to the rapid transit stations, but it was Mr. Ward's idea that after patrons had reached the rapid transit station they usually had several seconds and sometimes minutes in which purchases could be made. Acting on this theory, he went into the elevated and subway news-stand business.

Edward Wickham, treasurer of the Omaha & Council Bluffs Railway & Bridge Company, controlled by the Omaha & Council Bluffs Street Railway, Council Bluffs, Iowa, and president of the Citizens' Gas & Electric Company, is dead. Mr. Wickham was prominently identified with business and civic affairs in Omaha and Council Bluffs.

Manufactures and the Markets

News of and for Manufacturers—Market and Trade Conditions
A Department Open to Railways and Manufacturers
for Discussion of Manufacturing and Sales Matters

Improvements in Prospect in Fort Wayne

Approximately $1,300,000 will be spent by the Indiana Service Corporation, Fort Wayne, Ind., in the next year on improvements and construction work in Fort Wayne and vicinity. According to tentative plans outlined by President Feustel, a new car repair shop and machine and carpenter shops will be erected and some of the city lines will be double tracked. In addition to the heavy expenditures in the Spy Run north side plan and shops the company officials announce that new storage and rip tracks and freight house facilities will be built in the south side property recently purchased by the company. Mr. Feustel said the company also was considering the purchase of rolling stock equipment.

Republic Truck Receivership Lifted

The Security Trust Company, Detroit, Mich., has closed its receivership of the Republic Truck Company, Alma, Mich. The second and final payment of 6.0844 per cent to priority creditors and .97107 per cent to general unsubordinated creditors has been made. On July 30, 1924, priority creditors received about 88 per cent and general unsubordinated creditors 14 per cent. Nothing has been paid to subordinated creditors on their claim of $3,486,953, as by agreement their dividends have been added to those of the priority creditors.

Payments by receiver on unsecured claims of $4,861,741, including the $3,486,953 claim of subordinated creditors, total $727,686. A further small distribution of about $30,000 may be made if the government allows a tax refund of that amount. This is not expected.

The Security Trust Company was appointed receiver for Republic Truck Company Sept. 28, 1922, operating the plant for several months and in May, 1923, selling the property to a committee of first mortgage gold noteholders representing about 85 per cent of the $2,500,000 issue.

Many Bus Types Represented at Boston Show

The Boston Automobile Show, held March 7 to 14, maintained its reputation and repeated last year's accomplishment as the most important of the automobile shows in point of view of bus interest displayed. Sixteen-bus chassis or complete vehicles were on view. Parlor car types lead with six, but there were five street car or pay-enter bodies, four sedans and one bare chassis. The vehicles were designated as intended for use in school, tour or

ELECTRIC RAILWAY MATERIAL PRICES—MARCH 17, 1925

Metals—New York

Copper, electrolytic, cents per lb.	14.25
Lead, cents per lb.	9.00
Nickel, cents per lb.	31.00
Zinc, cents per lb.	7.62
Tin, Straits, cents per lb.	53.00
Aluminum, 98 to 99 per cent, cents per lb.	27.00
Babbitt metal, warehouse, cents per lb.:	
Fair grade	60.00
Commercial	28.00

Bituminous Coal

Smokeless mine run, f.o.b. vessel, Hampton Roads	$4.325
Somerset mine run, Boston	2.125
Pittsburgh mine run, Pittsburgh	1.825
Franklin, Ill., screenings, Chicago	2.125
Central, Ill., screenings, Chicago	1.90
Kansas screenings, Kansas City	2.625

Track Materials—Pittsburgh

Standard Bessemer steel rails, gross ton	$43.00
Standard open hearth rails, gross ton	43.00
Railroad spikes, drive, Pittsburgh base, cents per lb.	3.05
Tie plates (flat type), cents per lb.	2.425
Angle bars cents per lb.	2.75
Rail bolts and nuts, Pittsburgh base, cents, lb.	4.075
Steel bars, cents per lb.	2.10
Ties, white oak, Chicago, 6 in. x 8 in. x 8½ ft.	$1.60

Hardware—Pittsburgh

Wire nails, base per keg	2.90
Sheet iron (28 gage), cents per lb.	3.40
Sheet iron, galvanized (28 gage), cents per lb.	4.60
Galvanized barbed wire, cents per lb.	3.55
Galvanized wire, ordinary, cents per lb.	2.60

Waste—New York

Waste, wool, cents per lb.	16
Waste, cotton (100 lb. bale), cents per lb.:	
White	13–19
Colored	10–15

Paints, Putty and Glass—New York

Linseed oil (5 bbl. lots), per gal.	$1.11
White lead (100 lb. keg), cents per lb.	0.1625
Turpentine (bbl. lots), per gal.	0.945
Car window glass, (single strength), first three brackets, A quality, discount*	84.0%
Car window glass, (single strength), first three brackets, B quality, discount*	86.0%
Car window glass, (double strength) all sizes, A quality, discount*	85.0%
Putty, 100 lb. tins, cents per lb.	4–6

* Prices f.o.b. works, boxing charges extra.

Wire—New York

Copper wire base, cents per lb.	16.75
Rubber-covered wire, No. 14, per 1,000 ft.	$6.75
Weatherproof wire base, cents per lb.	19.00

Paving Materials

Paving stone, granite, 4x8x4, f.o.b. Chicago, dressed, per sq.yd.	....
Common, per sq.yd.	....
Wood block paving 3½, 16 lb. treatment, N. Y., per sq.yd.	$2.82
Paving brick 3½x8½x4, N. Y., per 1,000 in carload lots	51.00
Paving brick 3½x8½x3 N.Y., per 1000 in carload lots	45.00
Crushed stone, ¾-in., carload lots, N. Y., per cu.yd.	1.85
Cement, Chicago consumers' net prices, without bags	2.20
Gravel, ¾-in., cu.yd., f.o.b. N. Y.	1.75
Sand, cu.yd., N. Y.	1.25

Old Metals—New York and Chicago

Heavy copper, cents per lb.	11.625
Light copper, cents per lb.	9.75
Heavy brass, cents per lb.	7.00
Zinc, old scrap, cents per lb.	4.375
Lead, cents per lb. (heavy)	7.00
Steel car axles, Chicago, net ton	$16.75
Cast iron car wheels, Chicago, gross ton	17.25
Rails (short), Chicago, gross ton	19.25
Rails, (relaying), Chicago, gross ton	25.50
Machine turnings, Chicago, gross ton	10.75

sightseeing, electric railway and steam railroad service, as well as for bus-operating company service.

In the parlor car class were the following: Two Pierce-Arrows with Farnham-Nelson bodies, one Pierce-Arrow with Cutter body, one International Harvester and one International Motor (Mack), each with Lang body, and a White with the new Brown body, described as an "interurban parlor coach." The sedan types were exhibited by the Garford, Reo, Graham and Stewart New England representatives. These were all of the medium-sized type carrying from 15 to 18 passengers. Pay-enter or street-car type bodies were shown in the International (Mack) spaces by the Brown Body Company and by the Reo representative. The Mack contribution was a new 29-passenger body, both chassis and body being built by that company. Reo had a 21-passenger type with bodies by the Boston Body Company and the Fitzjohn Company. A source of continuous attention was the Mack Great coach, a six-wheel experimental job, which was shown last October during the American Electric Railway Association exhibit at Atlantic City.

Rolling Stock

Madison Railways, Madison, Wis., has purchased for June delivery six new safety cars of the latest design and construction at a cost of $48,000. The company has also purchased six buses at a cost of $54,000.

Cleveland Railway, Cleveland, Ohio, will probably be in the market for buses in accordance with its intention to run 80 or 90 of these vehicles by June 15. The plan of the company is referred to elsewhere in this issue.

City of Detroit Department of Street Railways, Detroit, Mich., has announced specifications on the 100 additional Peter Witt cars it is going to purchase. The details follow:

Number of cars ordered	100
Name of road	City of Detroit, Department of Street Railways
Type of car	Peter Witt
Seating capacity	52
Total weight	37,000 lb.
Bolster centers, length	23 ft. 9 in.
Length over all	48 ft. 5¼ in.
Truck wheelbase	5 ft. 3½ in.
Width over all	8 ft. 4 7/16 in.
Height, rail to trolley base	10 ft. 9⅜ in.
Body	Steel
Headlining	3-star Agasote, ⅜ in.
Roof	Arch
Air brakes	Straight
Axles	5-in.
Bumpers	Elliot type
Car signal system	Faraday buzzer
Control	K 35-H
Curtain material	Pantasote
Designation signs	Hunter
Door operating mechanism	National pneumatic
Hand brakes	Peacock staffless
Headlights	HDB-96
Journal boxes	Symington
Motors	Four 35-hp., 600-volt
Finish	Enamel
Sanders	Osgood-Bradley sand traps
Seating material	Rattan
Step treads	Kass
Trolley base	O B form 1
Wheels	26-in. steel

Guelph, Ont.—Five cars bought from the Guelph Radial Railway for operation on the Ontario Hydro-Electric Railways, Toronto and York District, Scarboro Division, have been overhauled, three by the Ottawa Car Manufacturing Company and two by the Toronto Transportation Commission. They have been equipped with Westinghouse 306-CV-4 motors and Canadian Car & Foundry Company trucks.

St. Catharines, Ont. — Underframes have been laid down at the Niagara, St. Catharines & Toronto Railway shops, St. Catharines, Ont., for two 60-ft. interurban cars, one for the Niagara, St. Catharines & Toronto Railway and the other for the Canadian National Electric Railways, Toronto Suburban District. They will be similar to the car built at the same shops for the Toronto Suburban.

Track and Line

Madison Railways, Madison, Wis., has ordered and will receive next month 120 tons of rails at a cost of $7,500. These rails will be used to double track Atwood Avenue from Division Street to Fair Oaks Avenue.

New York & Queens County Railway, New York, N. Y., is planning to double track its line between Flushing and Jamaica. For this purpose the company expects to use rails taken from its present lines between Corona and the Woodside carhouse and between St. Michaels Cemetery and Riker Avenue in Long Island City. Application is to be made to the Queens County Supreme Court for permission to abandon service on the lines from which the rail will be taken.

Montreal Tramways, Montreal, Que., ordered recently 50,000 ties and has asked tenders for 30,000 more. It has also asked prices for 2,000 tons of 115-lb., No. 508, Lorain section girder rail; 1,000 tons 85-lb. T-rail, No. 1, C. P. R. section; 3,000,000 lb. spikes; 200,000 tie plates, shoulder type; 11,000 standard tie rods; 30,000 lb. track bolts; 35,000 ft. of bonding cable; 100,000 tons broken stone; 20,000 tons sand and 100,000 bags cement.

Pittsburgh Railways, Pittsburgh, Pa., seeks in an ordinance the right to lay single car tracks on Diamond Street west of Grant Street, additional tracks on Diamond and Ross Streets and connecting curves and switches at various locations. The Council by unanimous action affirmed the ordinance, which will mean probable route changes.

Birmingham Electric Company, Birmingham, Ala., has been requested by a number of citizens of Fairfield to build a railway from Fairfield through several recent additions into Central Park. Such a line would save about 20 minutes time between Fairfield and Birmingham.

Chicago, North Shore & Milwaukee Railroad, Chicago, Ill., has taken another step to improve its right-of-way in Milwaukee, Wis. Considerable property has been purchased at Madison and Grove Streets. Residences on this line will be torn down to permit the removal of two curves at First Avenue and Madison Street, followed by another at Grove and Madison Streets. The tracks now in use will also be torn up, to be replaced by rails which will cross diagonally from Scott Street and First Avenue to Madison Street and Grove Street, eliminating the curves entirely. The improvement work will start shortly so that it will be completed by the middle of the summer. The improvement will cost $100,000. The Common Council must approve the plan.

Stockton Electric Railroad, Stockton, Cal., will commence work about April 1 on the extension of the Main Street line from its present terminal at Wilson Way 1 mile easterly to the city limits.

Capital Traction Company, Washington, D. C., plans to rebuild its tracks on M Street from 29th to 32d Street at a cost of $100,000. Work will start the end of March. The work will be done at the same time the District is widening and repaving the thoroughfare.

Power Houses, Shops and Buildings

Montreal Tramways, Montreal, Que., has ordered two 500-kw. rotary converters, with transformers, from the Canadian Westinghouse Company, and a switchboard for it from the General Electric Company for the St. Laurant substation, and two 1,000-kw. rotary converters, with transformers and switchboard, from the Canadian General Electric Company, for Hochelaga power house, and two 2,000-kw. rotary converters, with transformers and switchboard, from the Canadian General Electric Company, for its Mount Royal Avenue substation.

New York City, N. Y.—The Board of Transportation fixed April 2 for the receipt of bids for the construction of the inspection sheds of the Westchester and the Wakefield yards of the Pelham Bay Park and the White Plains Avenue branches of the Interborough subway in the Bronx.

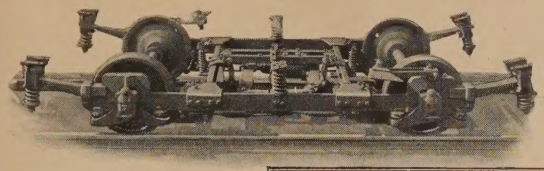
New Advertising Literature

General Electric Company, Schenectady, N. Y., has issued "G. E. Welding Electrodes," a 16-page illustrated booklet describing the characteristics and applications of the three types of General Electric electrode, designated as types A, B and C. Brief instructions are included covering the use of each type.

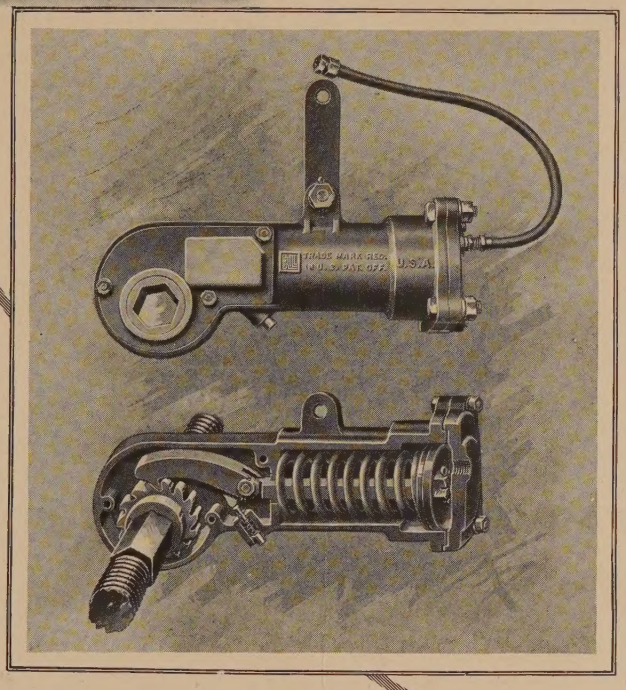
Bridgeport Brass Company, Bridgeport, Conn., has issued data book No. 16, containing prices and weights of sheet brass, brass rod, wire, condenser tubes and seamless brass and copper tubes. Copies may be obtained gratis on application to the Bridgeport Brass Company.

Martindale Electric Company, Cleveland, Ohio, has issued catalog No. 6, entitled "Motor Maintenance Equipment." This shows apparatus for slotting commutators and cleaning lamination slots, and tools for grinding commutators.

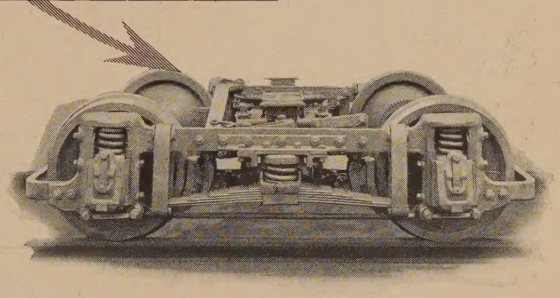
National Paving Brick Manufacturers' Association, Cleveland, Ohio has issued three pamphlets on vitrified brick pavements. They are "Brick Roads Outlast the Bonds," "Brick Pavements, City Streets, County Highways" and "Making Brick Pavement." The material is available to those interested.



Brill 79-E Truck



From Single to Double Trucks



Brill Low-Level 77-E Truck

Thirty-seven Per cent. More Brake Shoe Wear With Brill Automatic Slack Adjusters

An accurate test made with two double-truck cars, one equipped with Brill Automatic Slack Adjusters and other with hand-adjusted brakes, showed thirty-seven per cent. longer brake shoe wear when trucks are equipped with Brill Air-operated Automatic Slack Adjusters.

The application of this type adjuster to pivotal trucks, one to each truck brake rod, not only means longer brake shoe wear but also eliminates the necessity for brake rod adjustment by hand.

THE J. G. BRILL COMPANY
PHILADELPHIA, PA.

AMERICAN CAR CO. ST. LOUIS MO. — G.C. KUHLMAN CAR CO. CLEVELAND, OHIO. — WASON MANF'G CO. SPRINGFIELD, MASS.

RAILWAY
SUPPLIES
A combination that opens new possibilities
in Modernization and Maintenance
GENERAL ELECTRIC COMPANY
SCHENECTADY, N.Y.